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MALIGNANT LESIONS OF THE THYROID GLAND

A Review of 774 Cases

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IN THE past quarter of a century, progress in our knowledge of malignant tumor of the thyroid gland has fundamentally changed our conception of the disease and its treatment. Formerly in no organ other than the thyroid gland did the pathologist experience as much difficulty in distinguishing the microscopic picture of early malignant changes from certain benign changes incident to functional activity. For the most part, his errors were those of omission, that is, failure to recognize malignant changes when present. This lack of ability on the part of the pathologist, more than any other factor, served to retard progress in our knowledge of malignant lesions of the thyroid gland. Since the recognition of the disease by both the clinician and the pathologist formerly was limited, for the most part, to the advanced cases with large, fixed, infiltrating tumors associated with obstruction, pain, hoarseness, and other symptoms, it follows that the then prevailing conception of malignant tumor of the thyroid gland was based on the study of the disease in its late stage.

Curiously enough, a large share of our present knowledge of the subject has been acquired as a by-product during the process of developing surgery of benign tumors of the thyroid gland, rather than through any conscious effort toward a direct attack on the problem itself. As the operations for goiter increased in number and the pathologic changes in the goitrous glands became better understood, it was learned that of the nodular goiters removed for supposedly benign tumors, a small percentage showed malignant changes. In this manner proof was obtained of the obvious fact that carcinoma of the thyroid gland, as well as carcinoma elsewhere, has an early stage, and, if the tumor is then excised, the disease can be cured in a large percentage of cases. As a consequence of the alertness of the pathologists and the added experience in the treatment of these patients, our conception of this disease has been radically revised.

The basis for this review is a series of 774 patients with malignant lesions of the thyroid gland seen in The Mayo Clinic during the period 1907 to 1937, inclusive. Papers relating to different phases of the problem based on part of this material have been previously published (1, 2, 4, 10, 12–16, 20). In 517 of these cases the diagnosis was established by microscopic examination of the specimen of the tumor removed at operation (Table I), and in the remainder, 257, the clinical diag-

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nosis of inoperable carcinoma was so unmistakably clear as to require no biopsy for confirmation. In a paper, "Treatment of carcinoma of the thyroid gland," written in 1934 (15), I stated that a study of the ratio of malignant tumors to operative cases of goiter each year does not show any definite trend, except a moderate increase during the years since 1928. This increase I interpreted as relative, rather than actual, and attributed it to the tendency of patients to defer operation because of the economic depression.

Recently I determined the yearly ratio of operative cases of malignant thyroid tumors to the operative cases of benign nodular goiters for the period 1910 to 1937 inclusive. Viewed in their entirety, the figures presented a different picture. While the yearly ratios varied widely, there was no noticeable trend during the first 10 year period, but since then the figures show a definite and progressive increase in the proportion of malignant to benign tumors. This increase becomes more apparent when averages for 5 year periods are compared. Thus, since 1919, the ratio of malignant tumors to benign tumors has risen from 2 per cent to 4.9 per cent.

From these figures alone one is not justified in drawing the seemingly logical conclusion that the incidence of malignant lesions of the thyroid gland is increasing, for there is another factor which may affect these ratios, that is, greater ability of the pathologist to distinguish between early malignant and benign tumors. Therefore, it is probable that in recent years the relative number of patients with malignant thyroid tumors admitted to the clinic is not materially greater than that of former years but that we are now recognizing more of the early cases.

Of the 774 patients, 282 were males and 492 were females, a ratio of 1:1.74. For the same period the sex ratio of males to females for all benign nodular goiters, exclusive of exophthalmic goiters, was 1:5.07. The age incidence in this series corresponds for the most part to that of carcinoma situated elsewhere in the body, 69.6 per cent of the patients being within the age period 40 to 70 years, 52.8 years representing the mean age for males and 48.1 years for females (Fig. 1).

However, our experience would indicate that in children carcinoma shows a greater predilection for the thyroid gland than is generally appreciated. Four of our patients were less than 10 years of age, all girls, the youngest 7 years, and in the second decade of life there were 13 patients, 8 girls and 5 boys. Thus these 17 patients under 20 years of age constituted 2.2 per cent of our series. This finding is of immense practical significance, especially since the opinion prevails among many clinicians and surgeons that operation for the removal of thyroid nodules in children should be deferred until the patient has reached the age of 25 or 30 years. However, in my experience palpable benign tumors of the thyroid gland in children aged 14 years or less are rare, and I am in full accord with the warning of Kennedy (12) that any mass in the thyroid glands of children, however innocent appearing clinically, should be suspected of having malignant qualities. Of the malignant tumors in children a great percentage are of the papillary or malignant adenomatous type, of a low grade of malignancy, and therefore are, in their early stages, peculiarly amenable to treatment by surgery and irradiation.

For many years it has been generally recognized by all writers on the subject that the presence of a pre-existing benign adenoma of the thyroid gland is the most important known etiological factor in the development of thyroid carcinoma. The large incidence of malignant tumor that arises from fetal adenomas and the frequent pathological observation of definitely encapsulated degenerating adenomas, in parts of which malignant changes are taking place, are conclusive evidence of this etiological relationship.

However, my own experience leads me to question the accuracy of the estimations of previous writers, including myself, who have placed the incidence from 80 to 95 per cent. My figure of 87 per cent was calculated on a combined pathological and clinical basis, and I am confident now that this method is subject to many errors of interpretation. Because of the very low grade of malignancy in many of the cases, a malignant tumor may exist for a year or more without any clearly appre-

ciable growth, and because of the history of the presence of the tumor the error of ascribing its origin to a benign adenoma could be easily made from the record of the case. Likewise, in other cases the history may show that the patient has had a nodular goiter of many years' duration before operation, and operation may reveal that the malignant lesion developed in the non-goitrous portion of the gland. Thus, unless the facts are all clearly stated in the record, a reviewer can easily be misled as regards the relationship of the carcinoma to the pre-existing adenoma. It is therefore my belief that an accurate determination of the incidence is not possible from the review of records, and accordingly no attempt to do so was made in this series.

However, the fact that a large proportion of carcinomas of the thyroid gland originate in a pre-existent benign tumor is of immense practical importance in the prevention and treatment of malignant lesions of the thyroid gland. Obviously the prevention of endemic goiter will markedly reduce the incidence of carcinoma of the thyroid gland, and since there are no clinical signs or symptoms to indicate early malignant transformation, the potentiality of malignancy of every discrete thyroid tumor must be considered.

HYPERTHYROIDISM

Because the thyroid gland of patients with hyperthyroidism (exophthalmic goiter and hyperfunctioning adenomatous goiter) commonly shows hyperplastic changes, the possible etiological relation of hyperthyroidism to malignant lesions of the thyroid gland was investigated. In the series, basal metabolic determinations had been made in 245 patients: in 132, or 53.9 per cent, the rate was normal, that is, from −9 to +9 per cent; in 31, or 12.6 per cent, the rate was below normal, that is, −10 to −30 per cent, and in 82, or 33.5 per cent, the rate was above normal, +10 to +80 per cent. When the basal metabolic rates were checked according to the type of malignant lesion it was found that the percentage of rates above normal was as follows: cases of papillary adenocarcinoma, 28.2; adenocarcinoma in adenoma, 38.4; and diffuse adenocarcinoma, 32.9. In variability the rates in this series are comparable to those I previously reported and from them no clues can be derived to suggest that the hyperplastic change associated with hyperthyroidism is an etiological factor in malignant lesions of the thyroid gland. Furthermore, it is uncommon for malignant lesions to develop in the hyperplastic thyroid gland of exophthalmic goiter. This association was encountered in 10 pa-

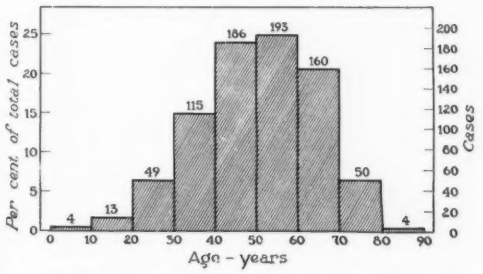

Fig. 1. Age distribution of patients with malignant tumors of the thyroid—774 cases.

TABLE I.—PATHOLOGICAL TYPE AND GRADE OF MALIGNANCY IN 517 CASES IN WHICH HISTOLOGICAL EXAMINATION WAS MADE—1907–1937

Pathological type	Total		Grade of malignancy				
	Number	Per cent	1	2	3	4	Not stated
Papillary carcinoma	155	30.0	97	54	1	0	3
Carcinoma in adenoma	197	38.0	46	99	32	18	2
Adenocarcinoma, diffuse	157	30.4	4	38	35	65	15
Epithelioma	4	0.8	0	0	3	1	0
Sarcoma	4	0.8	0	0	1	2	1
Total	517	100	147	191	72	86	21
Per cent of total graded cases (496)			29.6	38.5	14.5	17.3	

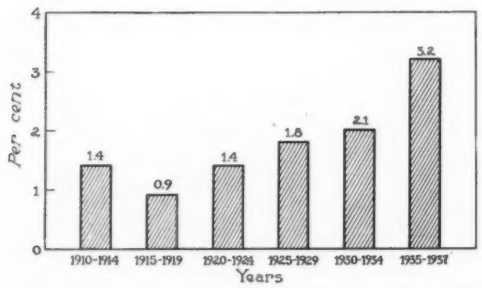

Fig. 2. Trend of percentage of malignant tumors discovered by pathological examination in patients operated on for thyroid tumors considered benign clinically.

tients in this series; in 4 the malignant lesion was confined to an adenoma, and in 6 it developed within the gland itself. Since these figures show that carcinoma of the thyroid gland has no constant effect on the basal metabolic rate and since commonly the carcinoma involves only part of the gland, it seems obvious that the variations in the level of the basal metabolic rate are dependent on the type of the coexistent benign thyroid tissue, rather than on the malignant tumor. The estimation of the basal metabolic rate is of no aid in the differential diagnosis of malignant tumor.

CRITERIA OF MALIGNANCY

Aside from the biological characteristics of these tumors which lend themselves to clinicopathological grouping, the most characteristic feature of malignant tumors of the thyroid gland is the high percentage of the tumors which are of low grade malignancy. While tumors of high grade malignancy often occur, analysis of the graded cases shows that in 68 per cent the tumor was of a low grade type, that is grades 1 and 2, on a basis of 1 to 4, a fact that is in keeping with the clinical course. Perhaps it is because of this feature that in the past pathologists experienced difficulty in recognizing them as malignant. In an attempt to find a criterion of malignancy other than that commonly accepted for malignant tumors elsewhere, Graham, after a painstaking study of a large series of cases, concluded that vascular invasion constitutes an absolute, and with some encapsulated nodules, the only criterion of malignancy. While the accuracy of Graham's observations is not questioned, many pathologists experienced in this field of study are agreed that this finding of vascular invasion is not necessary to the microscopic diagnosis of a malignant lesion of the thyroid gland. Instead, they rely on the presence of the usual criterion of malignancy elsewhere in the body, that is, anaplasia or cellular dedifferentiation.

Since the relative enlargement of the nucleolus has been long recognized as a characteristic feature of the malignant cell, Dr. C. H. Smith, a Fellow in The Mayo Foundation, at the suggestion of Dr. MacCarty, made a careful and painstaking study to determine the nucleolar-nuclear ratio in 5 specimens of fetal thyroid gland, 8 specimens of normal thyroid gland, 20 specimens of fetal adenoma, and 20 specimens of malignant adenoma of the thyroid gland. The average nucleolar-nuclear ratio for each type of specimen was: (1) fetal thyroid cells, 1:26; (2) normal thyroid cells, 1:25; (3) cells of fetal adenoma, 1:21; and (4) cells of malignant adenoma, 1:10. He concluded that in cells of malignant adenoma the nucleoli occupy a greater area of the nuclei than do the nucleoli of corresponding benign tissue. Therefore, these observations would indicate that there is to be found in the cell itself a measurable criterion of malignancy, and they also serve to confirm the diagnosis of malignant adenoma made by the pathologist based on his interpretation from the microscopic picture of the presence of anaplasia or cellular dedifferentiation.

That the alertness of the pathologist is an important factor in the recognition of early malignant tumors is indicated by the fact that during the past 18 years there has been a progressive rise in the percentage of malignant tumors discovered by the pathologist in patients operated on for thyroid tumors considered benign clinically (Fig. 2). The pathologist's alertness, I believe, is even more pronounced than these figures indicate, for during this period both clinician and surgeon, mindful of the difficulties of diagnosing early malignant tumors by clinical means, have also been more vigilant to detect any signs sug-

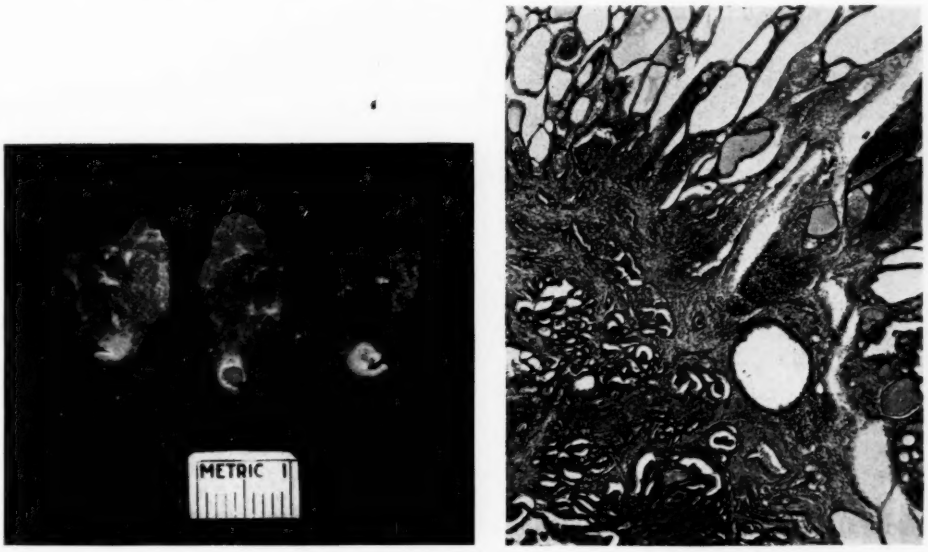

Fig. 3. Left, Gross and right, microscopic appearance of papillary adenocarcinoma.

gesting malignant transformation of the adenoma and thus have been able to pick up many cases that formerly would have been missed.

TYPES OF MALIGNANT TUMOR

There is a wide variation in the histopathology of malignant tumors of the thyroid gland, and because of a definite, although not constant, relationship between the clinical course of the disease and the pathological features of the growth, many attempts at classification have been made. Although in some instances the microscopic picture of one type may seem to merge with that of another, most pathologists and surgeons agree that there are distinctive features which lend themselves to, at least, clinicopathological grouping. Curiously enough, the different classifications vary, for the most part, as regards nomenclature rather than as regards the essential features. The more elaborate classifications of malignant tumors of the thyroid gland, based on histological differences in the architectural arrangements, have served more to confuse the student than to point out any important biological differences in the tumors.

The following classification has been used in The Mayo Clinic for many years and has been found adequate for the grouping of all the cases of primary malignant tumor of the thyroid gland: (1) papillary adenocarcinoma, (2) adenocarcinoma in adenoma (malignant adenoma), (3) diffuse adenocarcinoma; (4) epithelioma; and (5) sarcoma.

Papillary adenocarcinoma. This tumor is readily distinguishable histologically from other types of malignant tumor by its papilliferous structure. It arises either within an adenoma or from the portion of the gland free of adenomas. I believe that the latter origin is more common than the history would indicate. I can recall 4 occasions when I unexpectedly encountered this tumor in its early stage as a small bean-sized or pea-sized, firm, grayish or red nodule occupying a position just beneath the capsule on the lateral and posterior surface of the lobe in 3 instances, and on the anterior surface near the superior pole in 1 instance (Fig. 3). However, papillary adenocarcinomas are for the most part of a low grade of malignancy, grades 1 or 2, are accordingly of slow growth and may be present for a considerable time before invading

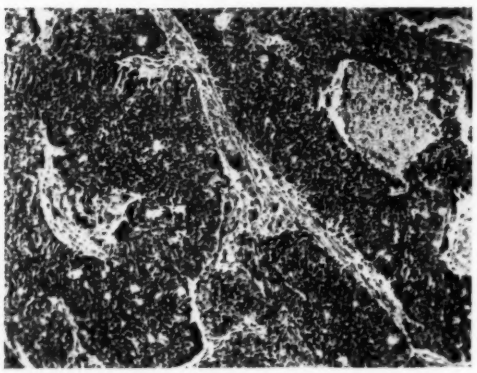

Fig. 4. Adenocarcinoma in adenoma (malignant adenoma).

the neighboring tissues. In spite of the low grade of malignancy, these tumors when nonencapsulated exhibit a predilection for invading the lymph nodes and spread to involve a cervical lymph node or a chain of nodes. Frequently the involved lymph nodes become manifest in the absence of any palpable nodule of the thyroid gland, and at operation for the removal of the nodes the primary tumor may be overlooked if the character of the cancerous nodes is not recognized. Even in neglected or recurrent cases, in which the condition is inoperable because of the fixation of the growth, rarely does metastasis extend beyond the mediastinum or the lungs. There is a close similarity in biological characteristics between this type of carcinoma of the thyroid gland and the papillary adenocarcinoma of the ovary, to which I previously called attention.

Frequently malignant tumors of thyroid structure are found in the neck separated from the thyroid gland and lateral to it. Since in my experience all have been papillary adenocarcinomas and since I have previously presented my views regarding their probable origin from the thyroid gland, I do not believe that they should be considered a separate group. They are, therefore, included with the other papillary adenocarcinomas.

Of the 517 cases in which a pathological examination was made, papillary adenocarcinoma was found in 155, or 30 per cent. In 117, or 75 per cent, of the 155 cases of papillary adenocarcinoma resection of the tumor was carried out, and in the remaining 38 cases or 25 per cent, the growth was inoperable and only a specimen was removed.

Adenocarcinoma in adenoma (malignant adenoma). As the term implies, this type of tumor arises from malignant transformation of benign adenomas, for the most part from "fetal" adenomas (Fig. 4). Commonly the tumor is single, but it may be multiple. Its structure is not uniform but varies within wide limits. In some cases the structure of the follicles is preserved in whole or in part; in others the follicular arrangement is completely lost, so that the tumor presents a picture of branching columns of undifferentiated cells. For the most part, these tumors are of a low grade of malignancy, grades 1 and 2, but occasionally tumors of grades 3 and 4 occur. Unlike papillary adenocarcinoma, tumors of this type do not spread by way of the lymph vessels until the capsule of the tumor is invaded, but on the contrary tend to metastasize early by way of the blood stream. This feature sometimes can be demonstrated at operation by the presence of sizable masses of carcinomatous tissue in the veins about the thyroid gland. Since the invasion of the capsule does not occur until late, and since the consistency and relative fixation of the tumor are not materially altered until its capsule is invaded, the malignant changes in these tumors are commonly not suspected before operation unless distant metastasis has been discovered. If the history reveals that there has been recent growth of the tumor, this, then, may be the only clinical feature to excite suspicion that the tumor may be malignant. There were 197 patients with adenocarcinoma in adenoma, which represented 38.1 per cent of the 517 comprising the series. Of the 197 patients with carcinoma in adenoma, 191, or 97 per cent, were subjected to partial thyroidectomy, and in only 6, or 3 per cent, was the process considered inoperable.

Diffuse adenocarcinoma. This type of tumor may arise within a pre-existing benign nodule or from a non-goitrous gland. It presents as wide a variety of cellular changes and histological patterns as tumors of similar

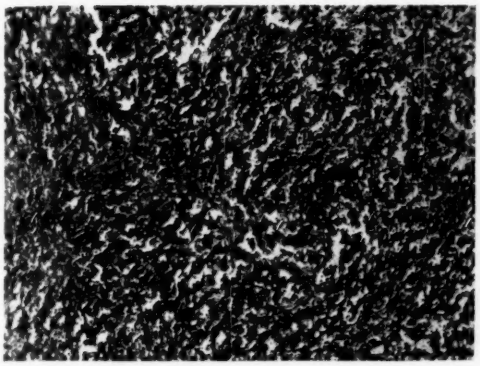

Fig. 5. Diffuse adenocarcinoma.

grades of malignancy situated elsewhere (Fig. 5). In the higher grades of malignancy, in which the follicular structure is completely lost, the arrangement of the rapidly growing cells, small, round, spindle-shaped, or giant, may simulate the picture of sarcoma. Not only have tumors of this type been mistaken for sarcomas, but pathologists confronted with two dissimilar pictures in the same tumor, one resembling sarcoma and the other carcinoma, have considered the process a compound one and have termed it "carcinoma-sarcomatode." The acute fulminating malignant growths of the thyroid gland are represented by this type. Metastasis occurs by way of the lymph vessels, or blood stream, or both. Because these tumors are for the most part more highly malignant than the tumors of the first two groups, their tendency to invade neighboring structures is more pronounced, and they are therefore more easily recognized clinically. There were 157 patients (30.4 per cent) with such tumors and resection was carried out in only 74, or 47 per cent.

Squamous epithelioma. This type of tumor of the thyroid gland is exceedingly rare and whereas its origin is commonly ascribed to extensions from the esophagus, trachea or thyroglossal duct, Broders (5) considers that the tumor may arise directly from the thyroid gland by metaplasia of the epithelium. Primary epithelioma of the thyroid gland occurred in 4 cases, in all of which the patients died within a year of the operation.

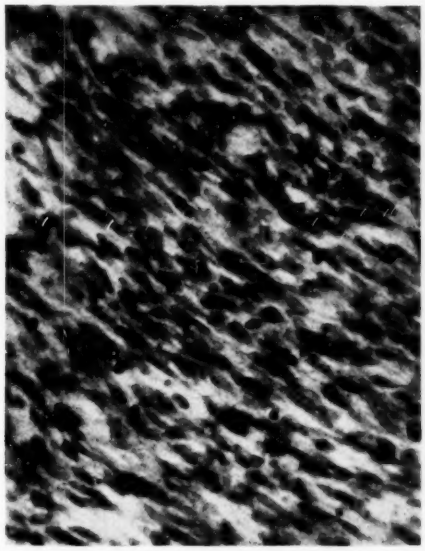

Fig. 6. Sarcoma of the thyroid.

Sarcoma. Because of the close microscopic resemblance of certain highly malignant carcinomas to sarcomas, pathologists have questioned whether sarcoma ever originates in the thyroid gland. Although the incidence as reported in the literature is perhaps far too high, sarcoma of the thyroid gland (Fig. 6) has been positively diagnosed in 4 cases, 1 of which was of primary osteogenic type. All 4 patients died within a year of operation (6).

METASTASIS

Mention has already been made of the routes by which the different types of thyroid tumor metastasize. A statistical study was undertaken to determine the sites of metastasis according to the type of malignant tumor in 112 cases in which metastasis was noted, in many instances on patients' readmissions subsequent to operation. Results are pictured in Figure 7.[1] The predilection of papillary adenocarcinoma to spread to the cervical lymph nodes, as shown in Figure 7, is in keeping with our clinical observations.

[1]Since some cases showed metastasis to more than one location, the total number of metastases is greater than the total number of cases in which metastases were noted.

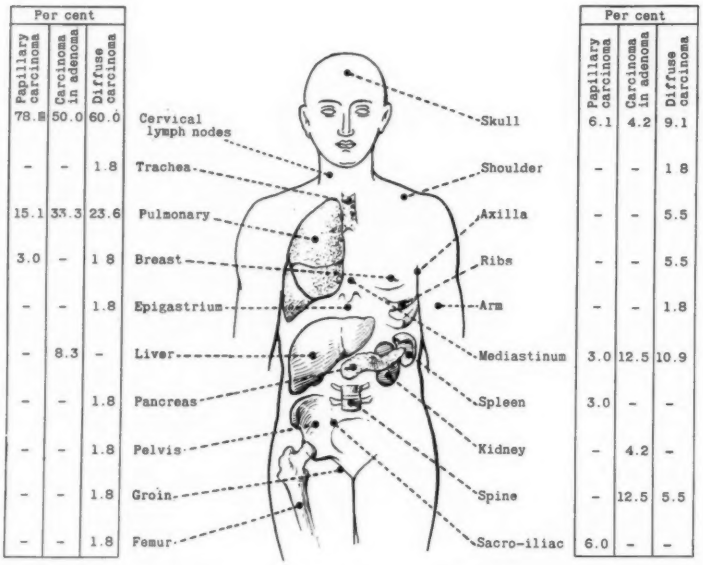

Fig. 7. Percentage distribution of metastases of malignant tumors of the thyroid by site of metastasis and type of tumor.

SYMPTOMS

As aforementioned, there are no signs or symptoms of early malignant tumor of the thyroid gland. However, as the disease progresses and before it reaches the inoperable stage there are in many cases findings which may lead to a tentative if not absolute diagnosis. The history of recent increase in the size of a pre-existing adenoma, the recent development of a tumor of the thyroid gland, the complaint of a sense of pressure in the neck, often out of proportion to the size of the tumor and the finding on palpation of a thyroid tumor that is firmer, more nodular, and relatively more firmly fixed than that usually encountered in benign goiters, are all suggestive evidence. While the contour of most benign enlargements of the gland conforms in general to the shape of its expanding bed, it is not uncommon in some cases of malignant tumor of the thyroid gland, before actual invasion through its capsule has occurred, to find part of the tumor pushing through a fascial compartment to present itself as a firm nodular projection. Thus, unusual irregularity in the contour of the tumor, together with its increased firmness, may constitute strong evidence of its malignant nature. Actual invasion of the malignant tumor through the thyroid capsule is commonly manifested by definite limitation of movement of the tumor, as well as by increased firmness. However, in cases in which the penetration of the cancer is limited to the posterior and mesial aspects of the gland, palpation may reveal no change in its mobility or consistency to suggest malignant changes. Yet in many cases of posterior invasion the inferior laryngeal nerve may be encroached on, sometimes without actual invasion, and the condition becomes manifest by a hoarse, brassy voice, together with fixation of the vocal cord in the cadaveric position. While a benign thyroid tumor may occasionally produce by pressure interference with the function of the cord, it is extremely rare for such a tumor to produce the combination of hoarseness and fixation of the cord. Thus, irrespective of the size, contour, or consistency of the thyroid tumor, hoarseness and a fixed vocal cord, in the absence of syphilis,

aortic aneurism or mitral stenosis, are almost pathognomonic of malignancy.

In the differential diagnosis the lesions most likely to be mistaken for malignant tumors of the thyroid gland are diffuse chronic or subacute thyroiditis, of the Riedel or Hashimoto variety, and hemorrhagic adenoma. Although in most instances one can be reasonably certain of the diagnosis when confronted with one of these conditions, the fact remains that the malignant character of any enlargement of the thyroid gland cannot be definitely excluded without surgical exploration. Thus in the review of the clinical diagnoses in the surgical cases, it was found that in 60 per cent the presence of a malignant tumor was not suspected, but was discovered at the operation or during the pathologist's examination of the tissue. Furthermore, of this group in which the diagnosis was not suspected, 8 per cent showed an advanced inoperable condition, indicating that even in the advanced cases there may be no clinical finding on which the diagnosis of malignant tumor can be based. On the other hand, of the group of cases in which the clinical diagnosis of malignant tumor was definitely made, which constitutes 23 per cent of the series, 42 per cent were found operable, and in the group in which the diagnosis of malignant tumor was suspected, which represents 18 per cent of the series, 62 per cent were operable lesions. It seems apparent, therefore, that in a fair proportion of cases in which the diagnosis of malignant tumor of the thyroid gland can be made from clinical examination, the tumor will be found to be resectable.

OPERABILITY

Of the 774 patients with malignant lesions of the thyroid gland seen in The Mayo Clinic from January, 1907, to January, 1938, operative procedures were carried out on 509.[1] Of this group, the tumor was extirpated in 384 and in the 125 remaining, biopsy of the gland or metastatic masses, excision of involved cervical nodes, tracheotomy for obstruction or a combination of these, was performed. The 384 patients who had a partial thyroidectomy represent 49.6 per cent of all patients with carcinoma of the thyroid gland seen during this period.

As I have previously stated, operability of carcinoma of the thyroid gland depends on the extent of the local invasion of the primary lesion and on the absence of distant metastasis. In the absence of distant metastasis, the relative fixation of the tumor is the most important feature to be considered in determining operability. Tumors which are completely fixed to all the contiguous structures should not be operated on, for it is obvious that the risk involved in extirpating the tumor is out of proportion to the amount of benefit that one could hope to obtain. However, if the mobility is limited in such a way as to suggest that the carcinoma has perforated the capsule of the gland at one place only, then exploration is justifiable, for frequently in such instances the tumor can be removed in its entirety. Even when the tumor cannot be removed completely, radium can be directly applied to the small fragment of carcinoma that is left attached. This procedure is especially applicable in cases of extensive carcinoma of the papillary adenomatous type; in this series there are several patients who have lived for many years in good health and without evidence of recurrence of the malignant tumor following partial removal of the primary lesion, supplemented by irradiation. The significance of carcinomatous involvement of the cervical lymph nodes, as regards operability, varies according to the type of malignant lesion. Unless the type is the low grade papillary adenocarcinoma, I consider it very doubtful whether radical removal of the carcinomatous process is ever justifiable. However, if the malignant lesion is of the papillary adenocarcinomatous type, metastasis to the cervical nodes does not constitute a contra-indication to radical removal of the primary lesion together with the involved nodes. On the contrary, if the primary lesion is operable, operation can often be undertaken at small hazard and with good prospects of effecting cure.

Among the factors that influence operability, aside from the fixation of the growth and the type of malignant lesion, the most important is the grade of malignancy. In

[1] Eight patients who had biopsy elsewhere were not included.

this series the grade was determined in 496 cases. Of the 338 cases of grades 1 and 2, 284, or 84 per cent, were operable; of the 72 cases of grade 3, 52, or 72.2 per cent, were operable; and of the 86 cases of grade 4, 46, or 53.5 per cent, were operable.

The appearance of enlarged (carcinomatous) cervical nodes months or years after removal of a malignant thyroid tumor, in the absence of a recurrent tumor in the thyroid gland, has not the same prognostic significance as the occurrence of enlarged nodes following operation for malignant lesions situated elsewhere. Here, it indicates that the primary lesion was of the papillary adenocarcinomatous type, and if the involved nodes are confined to the neck, surgical removal offers a reasonable chance of cure.

While biologically the behavior of papillary adenocarcinoma of the thyroid gland does not differ basically from that of cancer elsewhere, it is important that the surgeon recognize two characteristic features of the former: its tendency to spread by lymphatics to regional nodes and its relatively low grade of malignancy. In the practice of a surgeon it is seldom that a radical operation is indicated for the removal of recurrence or metastatic spread of a malignant lesion which has developed following an operation for the removal of a primary growth. In most such instances the surgeon correctly recognizes that the disease is well beyond control and wisely resorts to roentgen therapy as the best agency for checking its progress. However, when the primary lesion is a papillary adenocarcinoma of the thyroid gland, in many instances in which local recurrence and extensions of the lesion into the cervical nodes occur the condition may still be amenable to surgery.

Theoretically, the surgical procedure in malignant lesions of the thyroid gland should consist in wide removal of the primary growth, together with the regional lymphatic structures, but experience has proved that extirpation of the cervical nodes, unless there are reasons to suspect that they are actually involved, is seldom necessary in order to obtain the greatest benefits. The latter part of this statement, because it is at variance with the basic principles on which rests the surgical treatment of malignant lesions in general, deserves a word of explanation. Carcinoma of the thyroid gland, with the possible exception of the papillary type, seldom spreads by way of the lymph vessels until it has penetrated the capsule of the gland. If the growth is of the papillary type and has invaded the capsule, exploration of the cervical nodes on the affected side should be carried out and the nodes extirpated if found enlarged. Growths of high grade of malignancy, which have invaded the capsule, are commonly inoperable because of extensive fixation, and hence removal of as much of the primary lesion as possible, followed by irradiation, will accomplish as much as a more radical operation including removal of the cervical lymph nodes.

Commonly the operable carcinoma is completely encapsulated, which accounts for the fact that in so large a percentage of cases the malignant nature of the tumor is not suspected before operation. I consider that wide removal of these tumors is a sufficiently radical procedure. If the carcinoma is not definitely encapsulated, the operative procedure calls for total removal of the affected lobe. It is only for a very limited group of bilateral infiltrating carcinomas that removal of the entire thyroid gland is indicated.

If the carcinoma is not definitely encapsulated, a large, rubber drainage tube is left in the cavity, so that later (12 to 48 hours) radium may be inserted directly in the wound. Subsequently, in all cases, after the wound has partially healed, topical application of radium and treatment with roentgen-rays are given.

MORTALITY

The operative hazard in malignant tumors of the thyroid gland is dependent, for the most part, on the extent of invasion of the tumor, as well as the nature of the structures secondarily invaded. Among the 384 patients who underwent partial thyroidectomy, 7 died in the hospital, a mortality rate of 1.8 per cent. Among the 125 remaining patients on whom an operation was peformed, including biopsy of the gland or metastatic masses, excision of involved cervical lymph nodes or tracheotomy for obstruction, 5 died in the hospital, a mortality rate of 4.0 per cent.

TABLE II.—SURVIVAL AFTER TREATMENT ACCORDING TO TREATMENT

Treatment	Patients treated*	Patients traced	Lived 3 or more years after treatment		Patients treated*	Patients traced	Lived 5 or more years after treatment		Patients treated*	Patients traced	Lived 10 or more years after treatment	
			Patients	Traced cases—%			Patients	Traced cases—%			Patients	Traced cases—%
Thyroidectomy only	109	108	75	69.4	106	105	66	62.9	96	95	51	53.7
Thyroidectomy with irradiation	236	235	188	80.0	222	221	161	72.9	159	157	94	59.9
Irradiation only	159	158	46	29.1	139	138	32	23.2	91	90	13	14.4

*Inquiry as of January 1, 1938. The 3 year group comprises the patients treated 3 or more years prior to the time of inquiry, i.e., 1934 or earlier; the 5 year group comprises those treated in 1932 or earlier; the 10 year group comprises those treated in 1927 or earlier.

INOPERABLE CARCINOMA OF THE THYROID GLAND

In this series, irradiation therapy has been employed in the treatment of the inoperable cases and as an adjunct in many of the operable cases. Its value in reducing the size of the lesion and holding in abeyance inoperable and recurrent masses of malignant thyroid tumor has been long recognized. That it has also a definite value as a supplemental therapy in the operable cases is indicated by the fact that the survival rates are materially higher in the group of patients who were treated by thyroidectomy and irradiation than in the group who were treated by thyroidectomy alone.

RESULTS OF TREATMENT

As revealed by study of Tables II, III, and IV[1] the percentage of patients with malignant tumors of the thyroid gland who have lived 3, 5, and 10 years or more after treatment is gratifyingly high, and to those whose conception of the disease is based on the accepted teachings of 20 years ago, the percentage is amazing, if not unbelievable. Thus, of the patients who underwent thyroidectomy with or without irradiation treatment. the survival rates for 3, 5, and 10 years or more were 77, 70, and 58 per cent, respectively. Of the patients who were treated by irradiation alone, the survival rates for 3, 5, and 10 years or more were 29.1, 23.2, and 14.4 per cent, respectively (Table II). These survival rates should not be misinterpreted as indicating cures, that is, that these patients are free of a malignant tumor of the thyroid gland. They mean that the patients have lived the number of years indicated. As I previously pointed out, it is known that some of the patients who have lived 5 years or longer have local recurrence or persistence of the malignant lesion; the exact percentage is not known.

In order to determine what factors were of influence on the prognosis of treated cases of malignant lesions of the thyroid gland, the survival rates were calculated according to type of lesion and grade of malignancy and according to the pre-operative clinical diagnosis. As has been pointed out, the type of malignant lesion is of great importance in the operability, as well as in the method of surgical management that should be employed in cases of malignant lesion of the thyroid gland. The grouping of cases according to the pathological type of malignant lesion is of equal value in estimating the result of treatment, as shown in Table III. Thus, in the operable group, and to a lesser degree in the inoperable group, papillary carcinoma is the most favorable in its prognosis, carcinoma in adenoma is the next most favorable, while diffuse carcinoma is the most serious.

When the survival rates of the patients with carcinoma of the thyroid gland were determined according to the grading of malignancy, the results showed in unmistakable clearness what Broders (3) has previously demon-

[1]The survival tables presented in this paper, as the figures show, are based on a very high proportion of traced cases. Prior to 1936, tables giving survival rates for malignant lesions of the thyroid gland were based on a considerably smaller proportion of traced cases, and it was generally assumed that untraced patients were probably dead at the time of inquiry. In recent years the Division of Biometry and Medical Statistics of The Mayo Clinic has undertaken the responsibility of making the calculation of survival rates, and in this connection an exhaustive effort is made to render the follow-up as complete as possible. As a result the proportion of traced cases has materially increased. Owing largely to this fact, the survival figures in this paper vary in certain respects from figures in earlier papers.

TABLE III.—SURVIVAL AFTER TREATMENT ACCORDING TO PATHOLOGICAL TYPE

Surgical procedure and pathological type	Patients treated*	Patients traced	Lived 3 or more years after treatment		Patients treated*	Patients traced	Lived 5 or more years after treatment		Patients treated*	Patients traced	Lived 10 or more years after treatment	
			Patients	Traced cases—%			Patients	Traced cases—%			Patients	Traced cases—%
Thyroidectomy												
Papillary carcinoma	101	100	96	96.0	97	96	89	92.7	71	69	57	82.6
Carcinoma in adenoma	172	171	134	78.4	163	162	114	70.4	135	134	75	56.0
Diffuse carcinoma	69	69	33	47.8	65	65	24	36.9	48	48	13	27.1
Biopsy only												
Papillary carcinoma	32	31	22	71.0	28	27	17	63.0	21	20	7	35.0
Carcinoma in adenoma	4	4	1	25.0	4	4	1	25.0	3	3	0	0.0
Diffuse carcinoma	69	69	16	23.2	67	67	11	16.4	43	43	5	11.6

*Inquiry as of January 1, 1938. The 3 year group comprises the patients treated 3 or more years prior to the time of inquiry, i.e., 1934 or earlier; the 5 year group comprises those treated in 1932 or earlier; the 10 year group comprises those treated in 1927 or earlier.

TABLE IV.—SURVIVAL AFTER TREATMENT ACCORDING TO GRADE OF MALIGNANCY

Treatment and grade	Patients treated*	Patients traced	Lived 3 or more years after treatment		Patients treated*	Patients traced	Lived 5 or more years after treatment		Patients treated*	Patients traced	Lived 10 or more years after treatment	
			Patients	Traced cases—%			Patients	Traced cases—%			Patients	Traced cases—%
Thyroidectomy with or without irradiation												
Grade 1	109	108	104	96.3	104	103	96	93.2	80	78	63	80.8
Grade 2	146	145	125	86.2	138	137	104	75.9	109	108	67	62.0
Grade 3	48	48	30	62.5	45	45	23	51.1	35	35	14	40.0
Grade 4	42	42	4	9.5	41	41	4	9.7	31	31	1	3.2
Irradiation only												
Grade 1	16	15	11	73.3	15	14	9	64.3	11	10	2	20.0
Grade 2	22	22	12	54.5	19	19	9	47.4	15	15	6	40.0
Grade 3	10	10	4	40.0	10	10	3	30.0	6	6	1	16.7
Grade 4	29	29	4	13.8	28	28	2	7.1	15	15	0	0.0

*Inquiry as of January 1, 1938. The 3 year group comprises the patients treated 3 or more years prior to the time of inquiry, i.e., 1934 or earlier; the 5 year group comprises those treated in 1932 or earlier; the 10 year group comprises those treated in 1927 or earlier.

strated in cases of cancer of the lip, skin, and rectum, that "a poor prognosis is in direct proportion to the microscopic grade of malignancy and a favorable prognosis is in inverse proportion to the microscopic grade of malignancy." (Table IV).

Since a positive clinical diagnosis of malignant tumor of the thyroid gland is commonly directly related to the degree of fixation of the tumor by invasion into surrounding tissues, it has been stated by many writers that in cases in which a positive clinical diagnosis is possible, treatment is of no avail. This view is not in accord with my experience, since the percentage survival rates of the operable cases for 3, 5 and 10 years or more are 31, 22.5, and 16, respectively. However, it can be stated that the prognosis of thyroid carcinoma is in inverse proportion to the certainty of the clinical diagnosis (Fig. 8).

Therefore, when these 3 factors are considered, it will be seen from the foregoing tables that the outlook of thyroidectomy and irradiation is most favorable in papillary adenocarcinoma of grade 1, the malignant nature of which is not suspected clinically, and, conversely, the prognosis is least favorable in diffuse adenocarcinoma of grade 4, the malignant nature of which is diagnosed before operation (Table IV).

SUMMARY

A series of 774 cases of malignant lesions of the thyroid gland was reviewed; in 517 the diagnosis was established by microscopic examination of a specimen and in 257 the clinical diagnosis of inoperable carcinoma required no biopsy for confirmation.

The age incidence in carcinoma of the thyroid gland corresponds to that of carcinoma situated elsewhere in the body, although its occurrence in children is more common than generally suspected. Therefore any mass in the thyroid gland in children should be suspected of having malignant qualities. The sex incidence shows a ratio of 1 male to 1.74 females, whereas the ratio in benign nodular goiter is 1 to 5.07.

A large percentage of malignant tumors of the thyroid gland originates in a benign adenoma, which knowledge is of great importance in the prevention and treatment of malignant lesions of the thyroid.

The basal metabolic rates of patients with a malignant tumor of the thyroid gland are not constant and the co-existent benign tissue is probably what determines the patient's rate. The estimation of the basal metabolic rate is therefore of no aid as a diagnostic measure in determining malignant changes.

Analysis of the grade of malignancy of tumors shows that 68 per cent are of low grade, grade 1 or 2 on a basis of 1 to 4, which may account for the difficulty in recognizing them in the past. The histological criteria of malignant tumors of the thyroid gland are the same as those of malignant tumors elsewhere in the body, that is, anaplasia or dedifferentiation.

That the pathologist has become increasingly alert in detecting malignant tumors of the thyroid gland is shown by the fact that there has been a steady rise in the percentage of malignant tumors discovered in patients operated on for thyroid tumors considered clinically benign.

Malignant tumors of the thyroid gland are classified as follows: (1) papillary adenocarcinoma, (2) adenocarcinoma in adenoma (malignant adenoma), (3) diffuse adenocarcinoma, (4) epithelioma, and (5) sarcoma. Because of important biological differences all adenocarcinomas of the thyroid gland fall readily into one of three groups. The distinguishing clinical features of papillary adenocarcinoma are the low grade of malignancy, marked radiosensitivity, and the tendency for the disease to spread to regional lymph nodes, where it may be confined without further dissemination for many years. Therefore, metastasis to these structures is not necessarily a criterion of inoperability in this type, for radical removal of the primary lesion and the involved nodes, in conjunction with postoperative irradiation, offers a good chance for cure.

The essential clinical features of adenocarcinoma in adenoma are commonly the low grade of malignancy and the tendency to early dissemination of the carcinoma by way of the blood stream. Since lymph vessels are not involved until after the carcinoma has invaded the capsule, the presence of cervical metastasis in this type has a far graver prognostic significance than in papillary adenocarcinoma.

The diffuse adenocarcinomas of the thyroid gland are commonly of higher grades of malignancy than the preceding types and behave as diffuse adenocarcinomas situated elsewhere. Both squamous epithelioma and sarcoma of the thyroid gland are rare and very malignant.

A statistical study was made to determine the sites of metastases according to type of malignant lesion in 112 cases showing metas-

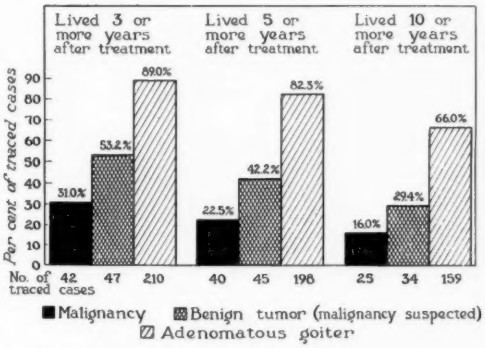

Fig. 8. Percentage of patients who survived for 3, 5, or 10 or more years after thyroidectomy classified by clinical diagnosis.

tases; the cervical lymph nodes were the most common site and the lungs next.

There are no signs or symptoms of early carcinoma of the thyroid gland. In the moderately advanced cases, recent growth, sense of pressure, and a tumor that is firmer and more nodular than that usually encountered in benign adenomas are suggestive evidence. In 60 per cent of the surgical cases the malignancy of the tumor was not suspected before operation.

The fixation of the tumor and the type and grade of malignancy are the most important factors to be considered in determining the operability.

The most effective treatment for malignant tumors of the thyroid gland is the combination of operation and irradiation, depending on the type and grade of malignancy. The rate of operability in these cases was 49.6 per cent.

The hospital mortality rate in cases of malignant tumor of the thyroid gland in which the patient underwent thyroidectomy was 1.8 per cent; when the patient underwent biopsy alone or in association with tracheotomy the hospital mortality rate was 4 per cent.

The percentages of patients with malignant tumor of the thyroid gland who have lived 3, 5, and 10 years or more after treatment are 77, 70, and 58, respectively. The prognosis is most favorable in cases of papillary adenocarcinoma, less favorable in carcinoma in adenoma, and still less favorable in diffuse carcinoma. The prognosis in cases of squamous cell epithelioma and sarcoma is extremely poor. When survivals were determined according to grading of malignancy it was found that the lower the grade of malignancy the more favorable the prognosis.

The statement by many writers that in cases in which a positive clinical diagnosis of malignant tumor of the thyroid gland is possible, treatment is of no avail, is not in accord with my observations.

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ACUTE CHOLECYSTITIS

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TWENTY years ago the operative therapy of acute cholecystitis was delayed until the acute manifestations of the disease had subsided. The propriety of this treatment was then rarely questioned. Since that time an ever increasing number of surgeons have advocated early or immediate operation in acute cholecystitis. Walton, Miller, Heuer, Graham, Zinninger, Mentzer, Stone and Owings, Judd and Phillips, and Smith are some of the authors whose experience contributes evidence in favor of this practice.

During the past year the literature has contained a greater number of articles in favor of early operation than opposed to it; however, there continues to be a great difference of opinion. It is the purpose of this paper again to present our experience with the early surgical treatment of acute cholecystitis—an experience which now comprises 219 consecutive cases subjected to operation in the early stages of the disease at the New York Hospital.

A review of the histories of the 219 patients treated in the early stages of acute cholecystitis is followed by a consideration of some of the controversial questions in the treatment of this disease.

The diagnosis, "acute cholecystitis," in this group of cases is based upon both clinical and pathological findings. Clinically, it has been reached by careful evaluation of the patient's history, of his symptoms and of the signs elicited on physical examination. In the typical case a fairly long history of recurring episodes of biliary colic frequently precedes the onset of the acute attack; in some, however, there is no record of previous symptoms referable to the gall bladder. The pain is severe, located in the right upper quadrant, and may radiate to the shoulder or back. Nausea and vomiting frequently accompany the onset of pain in these cases.

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The physical examination reveals marked tenderness and sometimes muscular rigidity in the right upper quadrant. The gall bladder may be palpable as a distended and tender mass. The patient looks ill, has a rapid pulse, some fever, and an elevated leucocyte count. Some patients whose attacks had lasted more than 24 hours showed a mild degree of jaundice.

Many of the 219 patients failed to present these characteristic manifestations of acute inflammatory disease. In some there was no fever; in others the leucocyte count was normal, and in still others the symptoms were not acute and, therefore, gave little hint of the seriousness and extent of the inflammatory process. In these atypical cases the final differential diagnosis was made on the basis of the findings at operation and in the pathologist's report.

At the operating table the surgeon finds a reddened, distended gall bladder with thick, edematous walls (see Fig. 1). Besides one or more stones, the organ usually contains colorless bile or pus under pressure. On close inspection, areas of necrosis and gangrene of the wall may be noted, and in some a frank perforation will be found with inflammatory reaction around the gall bladder and adhesions to neighboring structures. Free perforation with general peritonitis also may occur. The favorite location for such perforation is shown in Figure 2. This avascular area in the presence of inflammation of the gall bladder and compression of its blood vessels is most likely to become gangrenous first. Necrosis of this portion of the gall bladder in the presence of an increased intracystic pressure results in perforation and escape of the contents of the organ into the abdominal cavity. On gross pathological examination an acutely inflamed viscus with congested walls and areas of necrosis is described; microscopically, the specimen shows polymorphonuclear infiltration with desquamation of the epithelium and necrosis of one or all layers of the gall bladder.

Fig. 1. Cholecystectomy for acute cholecystitis. The acutely inflamed gall bladder is readily enucleated from its bed by careful dissection, thus preventing injury to the liver. Although this illustrates cholecystectomy being done by first dividing the cystic vessels and cystic duct, the procedure of first dissecting the gall bladder from above downward and then dividing these structures is employed by us even more frequently.

All of the 219 patients in this series fulfilled these clinical and pathological criteria for a diagnosis of acute cholecystitis and all were treated by early operation. Certain significant data have been derived from an analysis of these cases and they are presented in the accompanying chart and table.

A study Table I will show that the postoperative mortality is not unduly high after surgical treatment of acute cholecystitis unless perforation has taken place. Further it shows that two factors, besides the extent of the inflammatory process, have an influence on the outcome of the operation. The age of the patient at the time of operation is the first of these. It is evident that the mortality rate increases with age. The second factor is the duration of symptoms referable to the gall bladder before the onset of the acute attack for which operation is undertaken. That this contributes to the fatal outcome of operation may be seen in the increase in the mortality when the symptoms had been present more than 1 year before operation. The gravest situation in this series of cases was encountered in patients over 50 years of age whose gall bladder had perforated during an acute attack of cholecystitis which followed more than 1 year of symptoms referable to the biliary tract. All of the deaths in perforation were in these patients.

In the chart the two columns represent, respectively, the total cases and the total deaths in the series of cases. The shaded portion of each column illustrates the proportion of the total cases of acute cholecystitis in which gangrene occurred; the solid black portion, the incidence of perforation. Of particular signifi-

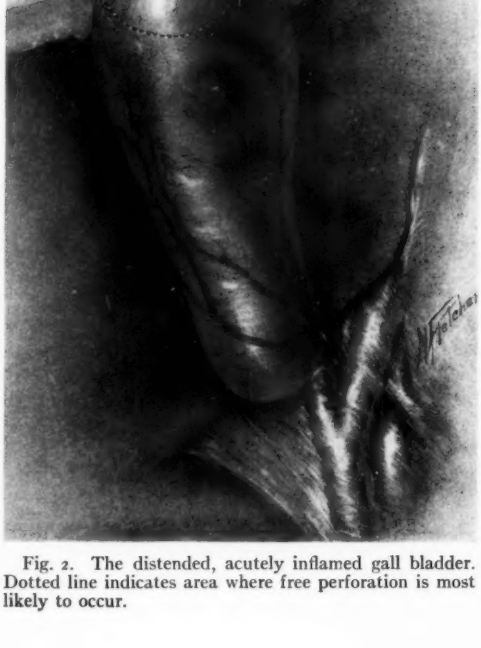

Fig. 2. The distended, acutely inflamed gall bladder. Dotted line indicates area where free perforation is most likely to occur.

cance in this chart is the fact that perforation occurred in 7.7 per cent of all cases and accounted for 27 per cent of the total deaths.

OPERATIVE PROCEDURE

The operation of choice in acute cholecystitis is a cholecystectomy, for it interrupts the pathological process and prevents the development of its serious consequences. This operative procedure is contra-indicated (1) in the presence of peritonitis following perforation of the gall bladder; (2) in conditions which make it difficult to identify the important structures in the biliary fossa. When the gall bladder is greatly distended and adherent, the adjacent viscera may be so distorted that anatomical relations are obscured, and there would be danger of inadvertently injuring the hepatic vessels or the common duct. (3) It is contra-indicated in the presence of severe jaundice caused by obstruction of the common duct. (4) It is contra-indicated in patients whose general condition is so grave that a general anesthetic and prolonged operative procedure are not justified. In such cases a compromise must be sought in the form of surgical treatment which will tide the patient over the immediate crisis without adding to his burden.

On the basis of the principles enumerated, 200 of the 219 cases of acute cholecystitis were subjected to cholecystectomy and in 22 of these the common duct was explored. In 19 cases cholecystostomy was done. An exploration of the common duct rarely is necessary in acute cholecystitis. Especially is this true of the younger patients, for common duct stones are not often seen unless the disease has persisted for a considerable time. The indications for exploration in acute and chronic disease of the biliary tract are not identical. If there is marked jaundice or a history of recurring attacks of jaundice, and if a stone is palpated in the duct, then the common duct must be explored. The duct may be indurated and may appear to be distended without harboring a stone. An icteric index of 30 or less may be due to an inflammatory process in the biliary tree rather than to obstruction of the duct by a stone. In general it may be said that the common duct should not be explored in acute cholecystitis unless definitely indicated. In this series of cases it was explored 22 times and stones were found and removed in 9 cases.

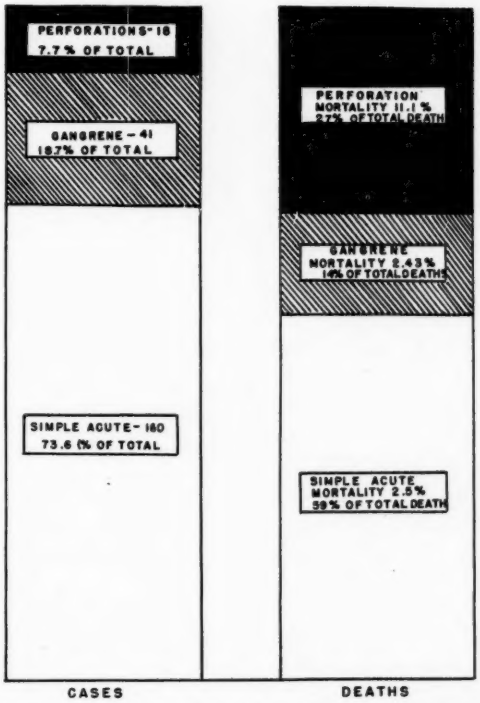

Fig. 3. Chart showing in left column comparative incidence of 3 types of cases of acute cholecystitis (219 cases); right column, comparative mortality in 3 types of cases of acute cholecystitis (7 cases).

ANALYSIS OF STUDY

In our experience the diagnosis of an acute process in the gall bladder is not difficult. However, the differential diagnosis of simple acute and complicated acute cholecystitis is very difficult, for the complications such as gangrene and perforation may occur in the presence of subsiding symptoms and normal temperature and leucocyte count. Only by planning an early surgical attack in acute cholecystitis can we hope to lower the mortality. Delay in operating tends only to increase the hazard of gangrene and perforation.

When the gall bladder is acutely inflamed, it is easily stripped from its bed without in-

TABLE I—ACUTE CHOLECYSTITIS

Extent of inflammatory process	Cases	Age	Duration of disease	Mortality—%
Total acute cholecystitis	219	Average age 46 years	Average duration 2.7 years	3.19
Acute without gangrene	160			2.5
		110 less than 50 years		1.8
		50 more than 50 years		8.0
			70 less than 1 year	0.0
			90 more than 1 year	4.4
Acute with gangrene	41			2.43
		27 less than 50 years		3.7
		14 more than 50 years		0.0
			14 less than 1 year	0.0
			27 more than 1 year	3.85
Acute with gangrene and perforation	18			11.11
		7 less than 50 years		0.0
		11 more than 50 years		19.9
			9 less than 1 year	0.0
			9 more than 1 year	22.2

juring the liver and other neighboring structures (see Fig. 1). The difficulties of the operation for acute cholecystitis are encountered in cases which have been permitted to proceed to gangrene and perforation or in those cases in which the disease has subsided, leaving the patient with an extracholecystic abscess or adhesions.

It is repeatedly stated in the literature that the removal of an acutely inflamed gall bladder is likely to be attended by the extension of the infection. This danger, in our opinion, is greater when an extracholecystic abscess or a localized peritonitis exists. It is true that streptococcic infection of the biliary tract is not uncommon; also, that these infections tend to spread when disturbed by operation. When great care is used not to spread the infection during operation, it has been demonstrated that fulminating streptococcic infections after cholecystectomy do not occur. Furthermore, contamination of the operative field with the contents of an acutely inflamed gall bladder does not invariably lead to extensive peritonitis. Drainage is applied in all cases at operation.

The postoperative course in patients under 50 years of age with simple acute cholecystitis is almost invariably uneventful. The older patients obviously are more likely to suffer postoperative complications. However, if time is taken before operation to counteract conditions such as dehydration, cardiac decompensation, etc., and the operation is planned so that it places little additional burden on the patient, the incidence of postoperative complications will be no higher during the acute stage of cholecystitis than in chronic affections of the gall bladder. It would seem that the danger of operating in uncomplicated acute cholecystitis is overemphasized. It is, we believe, distinctly less than the danger of gangrene and perforation which occur in a fair percentage of cases if a waiting policy is pursued.

The mortality rate was 3.19 per cent for the 219 cases irrespective of pathology, age, or other factors. Compared to the mortality rate for all operations for non-malignant disease of the biliary tract, which includes a series of 905 cases, this is a favorable figure. It must be stated here that the operations were performed not by one, but by twelve or more general surgeons.

SUMMARY

A review of the case histories of the 219 patients with acute cholecystitis who have been treated at the New York Hospital in the past 6 years is given.

It is shown by this series of cases that early operation may not be difficult nor attended by a greater incidence of complications nor a higher mortality rate than that ordinarily reported for series of operations for diseases of the gall bladder.

It is further shown that the outcome of an inflammatory process in the gall bladder is unpredictable. Therefore, delay in operating may lead to serious complications which greatly increase the difficulty of operation and the attendant mortality.

It is shown that the younger the patient when subjected to operation, the better the chance of an uneventful recovery and good end-result.

On the basis of these findings it is recommended that disease of the biliary tract be treated surgically as soon as the diagnosis is made unless the general condition of the patient makes such treatment dangerous without pre-operative therapy.

If this policy is pursued, we believe that the mortality rate in surgery of acute cholecystitis will be diminished and, perhaps, the progress of certain systemic diseases, such as cardiovascular and hypertensive disease, may be retarded.

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THE COLD PRESSOR TEST IN PREGNANCY

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VASOMOTOR instability, as shown by labile blood pressure, is widely recognized as a characteristic of early primary hypertension. Emotional stimuli, in the hypertensive or even prehypertensive subject, often elicit marked rises in blood pressure. Several tests have been devised in which an effort has been made to standardize the stimulus. Hines and Brown have proposed the "cold pressor test" which measures the response of the blood pressure to the immersion of one hand in ice-water. They state that prehypertensive patients give exaggerated blood pressure rises in the test, thus enabling the clinician to predict their eventual hypertension.

Many writers believe that the toxemias of pregnancy, exclusive of true nephritis, are related to primary hypertension. Corwin and Herrick "incline to the view that the subacute, hypertensive toxemia of pregnancy is the response of the woman with latent or declared cardiovascular disease to the strain of pregnancy." If the cold pressor test enables one to pick out the patients with latent or potential cardiovascular disease, as Hines and Brown believe, then perhaps it would also enable one to detect patients likely to develop toxemia of pregnancy. This would be of great importance for the study of toxemia and might even be of some benefit to the patient.

Randall, Murray, and Mussey seem to have been the first to publish studies of the cold test in pregnancy. From their preliminary results it seemed that normal reactions to the test might preclude future toxemia, though a few of their toxemia patients gave normal responses in early pregnancy and later gave hyper-reactions.

Reid and Teel, in their series of 159 observations antepartum and postpartum in 34 normal patients and repeated tests in 22 patients before and during toxemia, could find no constancy in the results of the test. Not only were the responses of the same patient markedly variable from time to time, but the test seemed to have no predictive value for either toxemia or primary hypertension. The test did not differentiate between primary and secondary hypertensions. They cite the work of Pickering and Kissin who studied the cold test in a series of non-pregnant patients and failed to confirm Hines and Brown in their conclusion that an exaggerated response to the test is indicative of potential, latent, or frank, primary hypertension.

Dieckmann, Michel, and Woodruff concluded that an abnormal response to the cold test indicated a good probability that the patient might "develop a toxemia in which the hypertension is the predominant finding."

Briggs and Oerting did cold tests on 233 pregnant patients. In patients having no family history of hypertension, only 2 hyper-reactors were found. Only 2 patients in this whole group showed any toxemia and these, who were diagnosed as chronic glomerulonephritis, were not the hyper-reactors. In 44 patients having one hypertensive parent there were 13 hyper-reactors. In this group 3 toxemias occurred, all in hyper-reactors. In 10 patients both parents were hypertensive. All gave hyper-reactions to the cold test, and 9 developed toxemia. The results of these various writers are summarized in Table I.

MATERIAL AND METHODS

In the present study, all clinic patients were taken who reported in their third or early fourth month of pregnancy. A cold test was done at this time and repeated at the end of the eighth, or early in the ninth month, and again 6 weeks or more postpartum. When the two antepartum tests showed wide divergence, as frequently happened, a third test was done at the patient's next clinic visit. In all, 539 patients were given the test. Of these, 22 did not deliver in the Margaret Hague

From the Department of Biochemistry, Margaret Hague Maternity Hospital.

TABLE I.—SUMMARY OF PUBLISHED DATA COMPARED WITH PRESENT STUDY OF COLD TEST IN PREGNANCY

Author	Cases		Number of tests	Blood pressure rise in millimeters mercury, systolic or systolic/diastolic			Toxemia		Minutes of ice-water stimulation
	Number	Per cent of all		Upper normal response	Mean response	Range of responses	Number	Per cent incidence	
Normal reaction to cold test									
Randall, Murray, and Mussey	79	79.0	?	20	6.5/7.8	?	0	0	1
Reid and Teel	35*	89.7	137	20	16.4/10.4	up to 62	5	14.3	2
Dieckmann, Michel, and Woodruff	62	40.8	?	29	18.6	?	2 (7)	3.2 (11.3)†	2
Briggs and Oerting	208	89.3	?	?	?	?	2	0.9‡	?
Present series Systolic	454	87.4	896	24	12.8	0—72	47	10.3	1
Diastolic	426	83.0	840	24	15.0	0—72	47	11.0	1
Hyper-reaction to cold test									
Randall, Murray, and Mussey	21	21.0	?	20	31.7/23.7	?	7	33.3	1
Reid and Teel	4	10.3	16+	20	20+	?	0	0	2
Dieckmann, Michel, and Woodruff	90	59.2	?	29	30+	?	15 (28)	16.7 (31.0)†	2
Briggs and Oerting	25	10.7	?	?	?	?	12	48.0	?
Present series Systolic	63	12.6	131	24	32	0—64	9	14.3	1
Diastolic	87	17.0	179	24	32	0—52	9	10.3	1

*18 patients had one cold test response of more than 20 millimeters mercury; 8 gave one response of more than 30 millimeters mercury.
†Including patients having "transient abnormal vascular renal signs."
‡Diagnosed as chronic glomerulonephritis.

Maternity Hospital. Therefore this study is based upon 517 deliveries. Two or more antepartum tests were done in 473 of these patients.

The patients were laid out flat on comfortable tables or cots, and after 20 minutes the blood pressure was checked repeatedly until it had apparently come to a basal level. Basal blood pressures were carefully obtained in all cases. The temperature of the ice-water was almost always checked at 2 to 4 degrees C., and in every case the patient's hand was in actual contact with ice-cubes. The hand was completely immersed well up to and over the wrist. Blood pressure readings were always made at 30 and 60 seconds, and every minute thereafter until the basal level had been attained. The hand was immersed for 1 minute; blood pressures were taken on the opposite arm. The diastolic pressure was taken at the point where the pulse sound abruptly changed tone and became muffled. All tests were done by one of us (E. R. C.).

RESULTS AND DISCUSSION

Reid and Teel seem to be the only investigators to have studied the reproducibility of the cold test response in pregnancy. Their results indicate that the response is so extremely variable as to make the test of questionable value at best. We have, therefore, compared the 2 (sometimes 3 or 4) antepartum tests in each patient, and also have compared all tests both antepartum and postpartum. The results may be summarized as in Table II.

Thus between the 2 most divergent tests, when usually only 3 tests were done, differences as high as 48 millimeters of mercury in the systolic, and 52 millimeters in the diastolic pressure rises were found. The average discrepancy was 8.2/10.3, with a standard deviation

TABLE II.—BLOOD PRESSURE RISE IN MILLIMETERS MERCURY—SYSTOLIC AND DIASTOLIC

	Number of cases	Mean*	Median	Mode	Standard deviation	Range
Difference in the most divergent antepartum tests	473	5.8/7.0	4.0/4.4		4.9/5.4	0/0—26/30
Difference in the 2 most divergent of all tests	483	8.2/10.3	7.5/9.9	6.7/7.5	6.8/7.5	0/0—48/52

*A mean divergence of 5.8/7.0 means that the average difference, between the most divergent tests in an individual, was 5.8 millimeters mercury in the rises in systolic pressure and 7.0 millimeters mercury in the rises in diastolic pressure.

TABLE III.—BIOMETRIC ANALYSIS OF RESPONSES IN PREGNANCY TO THE COLD PRESSOR TEST

Class		Number of cases	Blood pressure rise in millimeters mercury, systolic/diastolic				
			Mean*	Median	Mode	Standard deviation	Range
All patients		539	15.2/18.0	14.2/17.2	11.3/17.7	8.6/8.0	0/0—72/72
Family history	Negative	320	14.6/17.2	13.8/17.1	11.1/17.7	7.5/8.1	2/2—52/72
	Positive	214	15.7/18.3	14.6/17.3	11.6/18.0	9.0/9.1	2/2—64/56
Age	<20	137	14.4/17.6	14.1/17.7	11.3/11.5	6.6/9.6	0/0—36/40
	21 to 30	303	15.3/17.7	14.0/17.3	11.6/17.6	9.2/8.1	0/0—72/56
	31 to 45	98	16.0/17.0	14.8/16.4	13.2/16.9	9.2/8.2	0/0—64/52
Gravidity	I	275	15.1/17.8	14.6/17.7	11.4/17.8	7.5/8.1	0/0—52/72
	II	118	16.0/19.2	14.9/17.8	14.7/15.0	8.9/9.2	0/0—72/52
	III	63	13.6/16.8	13.0/17.4	11.0/18.2	7.4/7.4	0/0—36/44
	IV	32	13.2/16.2	12.2/15.3	11.0/14.1	7.2/7.9	0/0—32/36
	V	21	14.7/14.7	13.0/14.3		9.2/7.4	6/0—36/36
	VI+	29	15.2/16.6	13.0/15.8		11.3/8.8	0/6—64/52
Weight	<110	142	15.5/17.6	14.9/17.3	10.9/18.4	7.6/7.7	0/6—52/56
	111 to 150	308	15.3/18.2	14.2/17.8	11.4/18.0	8.7/8.4	0/0—64/52
	151+	89	13.3/15.9	13.0/15.5	11.1/15.2	7.1/9.0	0/0—36/72
Weight/height index	<1.75	141	15.6/17.0	15.3/17.3	11.0/17.0	8.1/8.0	0/0—52/56
	1.76—2.50	333	14.7/18.1	13.8/17.6	11.3/17.8	8.4/8.6	0/0—68/72
	2.50+	63	14.1/16.2	13.8/15.7	12.2/16.2	7.4/7.9	0/0—32/44
Basal blood pressure	<110/70	457	14.9/17.5	14.0/17.4	11.1/17.7	8.2/7.9	2/4—72/56
	111/71—135/85	78	17.2/21.3	17.0/16.1	14.0/10.7	10.3/9.6	0/0—64/52
	136/86+	4	22.0/22.6			7.2/9.1	14/10—32/36
Weight gain	0 to 18	111	15.1/17.0	14.6/17.0	11.1/17.7	7.8/7.9	0/0—40/40
	19 to 25	120	14.6/17.0	14.0/17.5	13.5/17.2	6.5/7.7	0/0—36/44
	26+	231	15.3/18.1	14.1/17.5	11.4/18.6	8.3/8.1	0/0—52/56
Patients who did not develop toxemia		461	15.1/17.8	14.1/17.1	11.3/17.7	8.2/8.6	0/0—72/72
Patients who did develop toxemia		56	15.7/16.9	14.8/17.3	13.0/16.7	10.1/8.3	0/0—64/52

*A mean blood pressure rise of 15.2/18.0 means that the average response to the cold test, in the specified group of patients, was a rise of 15.2 millimeters mercury in the systolic and 18.0 millimeters mercury in the diastolic pressure.

amounting to 80 per cent of the mean. Among the antepartum tests the variability is somewhat less, but as Reid and Teel concluded in "A Study of the 'Cold Test' in Normal and in Toxemic Pregnancy," that it is still too great for the test to have much reliability.

An analysis has been made of the relation, if any, between the average response to the cold test and family history of cardiovascular-renal disease and diabetes. The family history in many cases must be unreliable, but if the patient definitely stated or denied that a

parent or grandparent had had a disease in this realm the history was taken as positive or negative. The analysis shown in Table III indicated that there is no significant difference between the 2 groups in the average range of responses. The response to the test, in pregnancy, does not seem to bear any relation to family history of cardiovascular disease. This, again, is in agreement with Reid and Teel. It does not substantiate Briggs and Oerting.

The data in Table III are calculated from all tests, antepartum and postpartum except for the group of patients compared for the later development of toxemia. Since the postpartum test would not have any relevance for the prediction of toxemia, the data for this comparison represent antepartum tests only.

The response to the cold test in pregnancy is independent of age and gravidity, two factors which go hand-in-hand. According to Fishberg hypertension is more common in overweight, and particularly in squat subjects. It is interesting to see from Table III that in our series the response to the cold test is not influenced either by the weight or by the weight-height index. The data are too few to decide the question as to the effect of the basal blood pressure upon the response. In the cases presented there is no significant difference between the groups. The patients have been divided into 3 groups based upon the weight gain in pregnancy, because excessive gain is often a harbinger of toxemia. The response to the cold test is the same in patients who gained more than 26 pounds as it is in any other group.

In our experience the cold pressor test has had no predictive value for the toxemias of pregnancy. As the literature and our cases indicate, the incidence of toxemia is essentially the same in both normal and hyperreacting groups. The analysis in Table III shows no difference in the pretoxemia and the "prenormal" patients. We have taken a rise in blood pressure of 24 millimeters of mercury as the upper normal limit, but whatever normal we might select the conclusion would remain the same. In Figure 1 are shown the frequency distributions of the responses in normal and in pretoxemic patients. In the normal patients the range of response is wider than in the pretoxemic subjects. The distributions are roughly similar, although there were only 56 patients who subsequently developed toxemia.

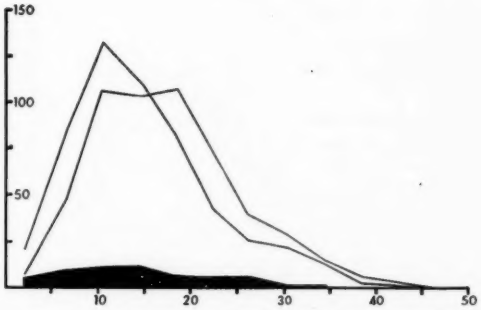

Fig. 1. The frequency distribution of average antepartum responses to the cold pressor test in pregnancy. The peaked curve represents the distribution of systolic rises in blood pressure in response to the cold test. The platykurtic curve describes the distribution of diastolic responses. Both are for patients who did not develop toxemia of pregnancy. The shaded area shows the distribution of responses in patients who did develop late toxemia. Three normal and one pretoxemic patients having blood pressure rises of more than 50/50 millimeters mercury systolic/diastolic are not shown because of the discontinuous distribution of responses. Ordinates represent number of cases; abscissæ, the average antepartum response to the cold pressor test, in millimeters mercury.

Randall, Murray, and Mussey found that 13 per cent of their patients had decreases rather than increases in blood pressure when given the cold test. We have only very rarely seen such a reaction and it has never been found upon repetition of the test.

Since our results with the cold test are not in accord with some of the published claims for the test, it might be worthwhile to emphasize that we did the test in the proper and approved manner as indicated in the description of methods given here.

In the first 93 patients of our series, the cold test seemed to promise well; 12 patients gave hyper-reactions and of these 5 developed toxemia. However, in the next 153 patients all toxemias developed in normal reactors and no toxemia appeared in patients giving hyperreactions. If these 2 groups had been taken as 2 series, comparable in length to some of the published series, diametrically opposite conclusions could have been drawn.

SUMMARY AND CONCLUSIONS

The published literature on the cold pressor test in pregnancy is summarized and tabulated. There is a close similarity in the reported incidences of hyper-reaction to the cold test, excepting 1 paper in which the incidence is 5 times that of the other publications. The predictive value for toxemia of pregnancy is unsettled. The series studied have been small. Reproducibility of the response to the test has not been considered in most cases.

In the present investigation, cold tests have been done in the third or early fourth month, again in the eighth or early ninth month and again 6 weeks or more postpartum in 517 women delivering in the Margaret Hague Maternity Hospital. This group is about equal in number to the total of the other 4 series reported.

The response to the cold test is inconstant. While many patients do give reproducible rises in blood pressure, others have given highly variable responses at different times.

The response to the cold test in our series is independent of family history of cardiovascular-renal disease and diabetes. It is also independent of age, gravidity, weight, weight-height index, weight gain in pregnancy, and perhaps also the basal blood pressure.

The incidence of toxemia is essentially the same in both normal and hyper-reacting groups. The frequency distribution of responses is essentially the same in both pretoxemic and "prenormal" groups.

We are especially grateful to Dr. S. A. Cosgrove for his sustained interest and efforts which made the work possible, and for his criticisms of the manuscript. We are indebted to many of the nursing staff of the Margaret Hague Maternity Hospital for their co-operation.

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THE USE OF SILK IN THYROID SURGERY

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A PRINCIPAL cause of wound complications in modern thyroid surgery is the use of catgut instead of fine silk. Halsted wrote, "when operating on two goiters the same day, employ catgut for the platysma suture in the one case and very fine silk in the other. There is not only greater local reaction in the cases sewed with catgut but in them the wounds will occasionally open at one or more points to discharge clear or cloudy fluid." More recently, the superiority of silk to catgut in thyroid surgery has been shown by Whipple, Meleney, and McGraw. Despite these studies, there is still a prevalent feeling that these wounds almost of necessity develop hematomas, that the use of a drain is necessary, and that infection is sufficiently frequent to contra-indicate the employment of a non-absorbable suture. The present study was undertaken to obtain evidence of the advantages of silk in thyroid surgery.

The material upon which this paper is based consists of 614 thyroidectomies. Silk was employed in 263 and catgut in 341 of these cases. Ten cases in which both types of suture material were used have been excluded. The wound complications have been divided into two groups, suppurative and non-suppurative. By non-suppurative complication is meant hematomas which require evacuation, palpable fluctuation or extensive induration requiring the application of heat for resolution, or a persistent discharge of serum for more than 4 days after the removal of the drain. A wound is considered infected whenever the drainage has been described as "cloudy," "yellow," "purulent," "seropurulent," etc. In most of the cases bacteriological proof of infection was available in the form of smears or cultures or both.

When silk was employed 0.38 per cent of the wounds developed suppurative and 13 per cent developed non-suppurative complications. When catgut was employed, these figures were 3.2 per cent and 40 per cent, respectively. In other words, the non-suppurative complications are three times, and the suppurative complications eight times as numerous when catgut is used instead of silk. When the cases are divided into two groups, toxic and non-toxic, depending upon the factor of hyperthyroidism, the superiority of the wound healing when silk is used is equally apparent (Table I).

The importance of the suture material as a factor in wound healing is further demonstrated in Figure 1, which shows the relationship between the annual incidence of wound complications and the use of silk in thyroidectomy. During the years 1913 to 1916 inclusive, when silk was liberally used for suture material, the incidence of complications is remarkably low.

With the introduction of catgut as the customary suture material in 1917, there is a sharp rise in the curve which persists with only slight variation until 1932. Since then there has been a steady increase in the use of silk and there is a correspondingly lower incidence of complications. That this striking reduction in the incidence of wound complications is attributable to the use of silk is shown by the fact that, during this same period, there is no such change in the percentage incidence of wound complications in the cases in which catgut was the suture material (Fig. 2). In fact, it is worthy of note that, in the last 20 years, there has been no decrease in the incidence of wound complication in cases in which catgut was used. The faulty healing of wounds which occurs in the presence of large amounts of catgut is due to the irritating action of halogens and metals which are released during its absorption (4). Chromicized catgut is particularly deleterious in this respect.

From the Surgical Service of the Peter Bent Brigham Hospital.

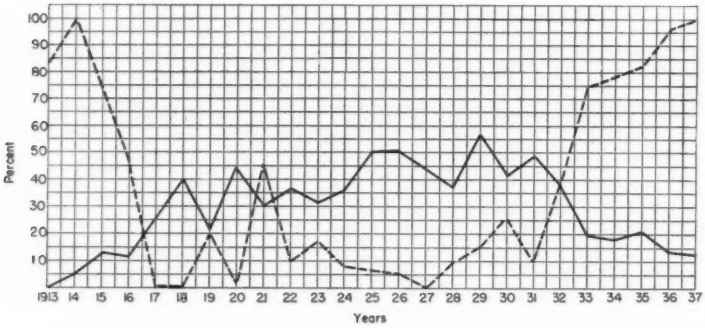

Fig. 1. Graph showing the relationship between the incidence of wound complications in thyroid surgery and the use of silk sutures in 604 thyroidectomies at Peter Bent Brigham Hospital: 263 sutured with silk, 341 with catgut. - - - Percentage in which silk was used; —percentage of total wound complications.

In order to determine the comparative importance of the suture in the healing of thyroidectomy wounds, a study of the following factors was made: the age of the patient, the degree of hyperthyroidism, the type of anesthetic used, cachexia of the patient, the presence of diabetes mellitus, the use of drains, and the technique of the operator. The incidence of wound complications was found to be higher in the older age groups and in the hyperthyroid cases. However, when the cases were divided into two groups according to the type of suture employed, it was found that the influence of these factors was very marked when catgut was used and negligible when silk was used. This has been interpreted as evidence that, as Shambaugh has shown (7), the slower healing of the wound renders complications more likely in the aged. The irritating effect of catgut increases this tendency, whereas silk has no such deleterious influence.

TABLE I.—EFFECT OF SUTURE MATERIAL UPON THE INCIDENCE OF WOUND COMPLICATION FOLLOWING THYROIDECTOMY FOR TOXIC AND NON-TOXIC GOITER

Type of case	Suture material	Number of operations	Wound complications			
			Suppurative		Non-suppurative	
			No.	Per cent	No.	Per cent
Toxic	Silk	177	1	0.56	25	14.1
Toxic	Catgut	242	10	4.1	115	47.5
Non-toxic	Silk	86	0	0	70	11.6
Non-toxic	Catgut	99	1	1.0	23	23.2

This is emphasized also in the hyperthyroid cases in which the technical difficulties encountered in the removal of friable vascular glands, especially bleeding, necessitate greater handling of tissues and the use of larger amounts of suture material. The use of silk in such cases minimizes wound complications. That hyperthyroidism is not *per se* a cause of wound complications is shown by the low incidence of complications which occurred when silk was used, even in cases of comparatively uncontrolled hyperthyroidism in the period before the use of iodine (Fig. 1). Moreover, the incidence of wound complications in the most severe cases of hyperthyroidism, namely, those in which a crisis occurred, was no higher than in the less toxic cases.

The influence of the anesthetic upon the subsequent morbidity was studied and a significant deleterious effect was noted only when the use of catgut was combined with a local infiltration anesthetic. When silk was used with local anesthesia, no such effect was produced. No correlation between the amount of weight which a patient had lost and the incidence of wound complications could be found in this series. No studies for vitamin C deficiency were made. There were 8 cases of diabetes mellitus, none of which developed wound complications. Controlled diabetes,

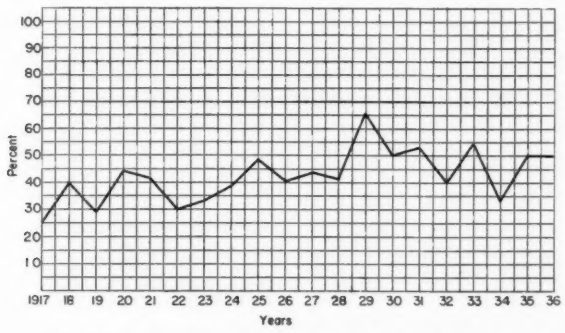

Fig. 2. Graph showing the annual percentage of wound complications in cases in which catgut was used—341 cases. There has been no decrease in the percentage of complications in 20 years.

therefore, was not a factor in the production of wound complication in this series.

The rôle of drains in the production of infection is difficult to evaluate because the circumstances for which drainage is instituted are often responsible for the infection. The presence of hematomas in this connection is well known (13). However, it seems significant that in this series not a single thyroidectomy, either for toxic or non-toxic goiter, in which fine silk was used and the wound was closed without drainage, was followed by infection. In this group there were 20 instances in which a hematoma formed in the wound but it did not require evacuation and infection did not supervene. When drainage was employed the incidence of infection was 1.4 per cent when silk was used and 4.2 per cent when catgut was used. The percentage incidence of infection was, thus, three times as high in the drained as in the non-drained cases (Table II).

It is frequently stated that if the same meticulous technique was employed with catgut as with silk the superiority of silk would be shown to be more apparent than real. Although a careful technique is essential, the present study indicates that comparable results are not obtained with catgut. A and B are two senior surgeons on the staff of the Peter Bent Brigham Hospital. Both surgeons are painstaking and meticulous operators. Surgeon A has nearly always employed fine silk in his cases and Surgeon B fine catgut. On occasions, however, each has departed from

TABLE II.—EFFECT OF THE USE OF DRAINS ON THE INCIDENCE OF WOUND COMPLICATIONS IN THYROID SURGERY. WHEN FINE SILK WAS USED AND NO DRAINAGE, NO SUPPURATIVE INFECTIONS OCCURRED

	No. of operations	Wound complications			
		Suppurative		Non-suppurative	
		No.	Per cent	No.	Per cent
Drained silk wounds	68	1	1.4	15	22.0
Undrained silk wounds	195	0	0	20	10.2
Drained catgut wounds	213	9	4.2	85	39.9
Undrained catgut wounds	128	2	1.56	53	41.4

TABLE III.—COMPARATIVE INCIDENCE OF WOUND COMPLICATION, WHEN USING SILK AND CATGUT SUTURES, OBTAINED BY TWO METICULOUS OPERATORS, ONE ACCUSTOMED TO THE USE OF SILK BUT OCCASIONALLY USING CATGUT, AND VICE VERSA

Operator	Suture material	Wound complications per cent
A	Silk	8.9
	Catgut	33.0
B	Silk	0
	Catgut	36.9
Hospital staff	Silk	13.8
	Catgut	43.6

his own custom. Table III shows the incidence of wound complications obtained by the two surgeons when using the different suture materials. Note that both surgeons have a low incidence of complications when silk is used and a high incidence when catgut is used. That the technique of these surgeons was unusually careful when using catgut is shown by the fact that the percentage of wound complications obtained by them is lower than that obtained by the remainder of the surgical staff (Table III).

Efficient methods of sterilization of instruments and drygoods, careful cleansing of the skin, exclusion of the skin from the operative field, adequate masking of the operating room personnel, gentle handling of tissue, and meticulous hemostasis are fundamental principles without which satisfactory results with a fine silk technique cannot be obtained (1, 3, 6, 13). At the Peter Bent Brigham Hospital, attention always has been directed to these details, but occasionally inexplicable, severe wound infections have been encountered. Recently a number of improvements in methods of sterilization have been inaugurated by Walter (10, 11, 12). It is hoped that these changes will reduce still further the incidence of wound complications.

Granting that the incidence of wound complications is appreciably lower when fine silk is used, an important question must be considered. What happens when silk is used and infection develops? In this regard the opinion of Halsted is of interest: "If fine silk were used and the infection slight probably none of the buried threads would be extruded nor would healing be delayed demonstrably on account of their presence. When heavy silk has been used for any of the sutures and suppuration is considerable one or more or perhaps all of the threads would have to be removed. Even in such cases, it is very unlikely that the ligatures and fine sutures would give trouble." Recent studies (2, 7, 8, 9) have confirmed this statement. Although occasionally the presence of silk may delay healing, this is the exception rather than the rule. If a very fine grade of silk is used,[1] if all sutures are cut close to the knot, if no continuous sutures are employed, and if strangulation and necrosis of tissue are avoided, little or no trouble is encountered in the presence of infection. For ideal results when using silk, the size must be sufficiently small to permit complete encapsulation with mononuclear phagocytes if suppuration occurs. If a silk of small size is used persistent sinus tracts will not form for the foreign body will become completely encapsulated. After extensive infection, fine silk may be extruded from the wound; but if it is of small size, this will cause no discomfort to the patient and will not impair the solidity or final cosmetic appearance of the wound.

It is not intended that this study will encourage surgeons who have employed catgut for years to use silk in thyroidectomy. Such a change requires more than simply adopting a new suture material and it would not be practical for most surgeons to attempt it. Moreover, in no instance in this series was a wound complication responsible for a fatality.[1] However, there are certain practical advantages of the use of silk in thyroid surgery which merit consideration. Tenderness, swelling, and induration of the wound seldom develop. Consequently, the patients are more comfortable. The febrile period and the average hospital stay are about 3 days shorter with silk than with catgut. Nearly all of the patients are able to leave the hospital without a dressing on the wound and repeated dressings and probings of the wound after discharge are rarely necessary. The use of silk, therefore, shortens the period of morbidity and adds materially to the comfort of the patient.

SUMMARY

1. A study of the factors involved in the healing of over 600 thyroidectomy wounds reveals that when fine silk was used instead of catgut, the incidence of non-suppurative wound complication was reduced from 40 per cent to less than 15 per cent and the incidence of suppurative complications from 3.2 per cent to 0.38 per cent.

[1]No. 4—Champion Twist or smaller.(Gudebrod Brothers Company)

[1]Postoperative hemorrhage is not included as a wound complication. It occurred in slightly less than 1 per cent of the cases regardless of the suture material employed and is attributable to the operator rather than to the suture.

2. Suppurative complications were more frequent in the cases in which drainage of the wound was employed. In this series there were no infections following thyroidectomy when fine silk was used and the wound closed primarily.

3. No other factor produced so favorable an influence on wound healing as the use of fine silk. Comparable results were not obtained with catgut even when a careful technique was followed.

4. The importance of a careful technique and proper methods of sterilization of instruments and drygoods is emphasized.

5. Postoperative discomfort is minimized and the period of morbidity shortened when silk is used.

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INTRASPINAL CAUSES OF LOW BACK AND SCIATIC PAIN

Results in Sixty Consecutive Low Lumbar Laminectomies

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THE purpose of this report is to review the findings in a series of 60 consecutive cases in which a lumbar laminectomy was performed for the relief of low back and sciatic pain. The series, therefore, comprises a heterogeneous group pathologically, but clinically a group not easily differentiated. We believe that in no other way than by a summarization of such a consecutive series of surgical cases can a proper perspective of this perplexing problem be obtained.

The symptomatology of the entire group was, with minor variations, the same. However, based upon the gross and microscopic findings the patients logically fall into 4 groups: (1) herniated nucleus pulposus (35); (2) hypertrophy of the ligamentum flavum (13); (3) true neoplasms (3); and (4) negative surgical explorations (9). In attempting to analyze the data we shall discuss first the symptoms and signs common to the entire group and then attempt to correlate the symptomatology with a particular pathological lesion.

SYMPTOMS

There are certain symptoms especially important in examining the patient with low back and sciatic pain. Recurring episodes of similar pain are characteristic of the intraspinal lesions, particularly of the herniated nucleus pulposus. Therefore, a history of a previous episode may be important in the differential diagnosis. Exaggeration of the pain by coughing and sneezing is of especial importance, even if present at one stage of the illness and absent at the time of examination. When the pain is thus intensified, it may be most severe in the lower back or gluteal regions rather than in the peripheral distribution of the sciatic nerve. Inquiry in regard to partial or complete impotence is of importance inasmuch as this symptom is frequent in lesions compressing the sacral roots.

In performing the neurological examination it is important to note whether the patient lists toward or away from the painful side. Spasticity of the lumbar muscles is common and usually accompanied by limitation of movement. This limitation is apt to be much greater in flexion than in lateral movement or extension of the spine. This finding, varying in degree from slight limitation to almost complete immobility, was present in every patient of our series. Compression of the jugular veins in some instances increases the pain (Naffziger test) and when positive we consider the test to be pathognomonic of an intraspinal lesion. Every one of the lumbar and sacral dermatomes should be tested for changes of sensation to pin prick, cotton wool, heat, and cold. Sensory changes, subjective or objective, are most helpful in localization of these lesions. In addition to testing the power of the flexors and extensors of the hip and knee it is important to test minutely the motor power in the dorsiflexors, plantar flexors, evertors and invertors of the ankle, and the extensors and flexors of the toes.

Lasègue's test is probably the most reliable one for demonstrating sciatic nerve irritation. It is performed by raising the thigh to right angles with the trunk with the knee flexed. Then the leg is extended on the thigh to the point, if any, at which pain begins along the course of the sciatic nerve. Without further moving the leg or thigh the foot is passively dorsiflexed to determine if this additional pull on the sciatic nerve exaggerates the pain. Lasègue emphasized the fact that many of his patients with severe "sciatica" kept the foot of the affected side in plantar flexion and

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could not press it flat to the floor without agonizing pain.

The separate spinous processes of the lower lumbar vertebræ and the sacrum should be percussed and pressed firmly in a lateral direction to elicit tenderness. Although it occurs rarely, if manipulation of the spinous processes reproduces the patient's sciatic pain, it is considered of special significance.

In every case in which there is a localized area of pain along the course of the sciatic nerve or its branches careful local examination for regional pathology should be made. We have recently observed a patient with typical sciatic nerve irritation in whom a large streptococcic abscess was demonstrated deep in the gluteal region. Occasionally, neuromas, other tumors, or inflammatory masses in the course of the sciatic nerve are discovered, thus giving an extraspinal answer to the cause of "sciatica."

Pain was the disabling factor in 59 of the 60 patients. In 1 patient with hypertrophied ligamentum flavum there was no pain, but a trophic ulcer of the heel, incontinence of urine and feces, and saddle anesthesia were present. Although sciatic pain was not a symptom in all cases, there was a positive Lasègue's test in every patient operated upon. The degree of positiveness, however, was quite variable, the test being very marked in all cases in which sciatic pain was the most prominent symptom.

As would be expected, the Queckenstedt test was normal in all instances since the spinal puncture was made above the level of the suspected lesion.

ANALYSIS OF DATA

Herniated nucleus pulposus. Herniated nucleus pulposus was found in 35 patients. In 29 patients simple herniation through a small aperture in the annulus fibrosus was found; in 3, simple bilateral herniation; in 3, a disruption of the posterior part of the disk with both annulus fibrosus and nucleus pulposus protruding into the canal. Twenty-one herniations were at the level of the fourth lumbar disk, 13 at the lumbosacral disk, and 1 at the third lumbar disk. Twenty-five were males and 10 females. The ages ranged from 17 to 60 with an average age of 40 years. There was a definite traumatic history in 17 cases, questionable in 4, and negative in 14.

Sciatic pain was the first symptom in 16 patients, or 45 per cent, low back pain the first complaint in 18, or 52 per cent, and 1 patient noted the initial pain in the hip. At the time of examination, months, or years later, sciatic pain was the major complaint in 51 per cent of the patients and in 40 per cent the chief complaint was low back pain accompanied by sciatic pain. In the remainder the major pain was in the hip, groin, or sacral region in addition to the back.

The duration of symptoms in this group varied from a few weeks to 23 years with a tendency toward exacerbations and remissions. In 13 cases, or 40 per cent, there had been previous attacks of pain with occasional symptom-free periods. There was pain on coughing, straining, and sneezing in 27 cases, or 77 per cent. In 12 instances, or 35 per cent, the Naffziger test was positive.

Demonstrable hypesthesia or anesthesia in one or more of the lumbar or sacral dermatomes occurred in all except 8 patients, or in 77 per cent. In 1 patient there was only perianal hypesthesia. The hypesthesia or anesthesia involved the lateral aspect of the calf, particularly just above the ankle, in 23 patients, or 65 per cent. In other instances, the great toe or the lateral 3 toes were also involved. In 21 cases, or 60 per cent, the hypesthetic or anesthetic areas were limited to the lateral aspect of the leg and the foot.

Because of the severe pain in many cases it was difficult to evaluate the degree of motor deficit. When it appeared that weakness was purely secondary to the pain caused by muscular contraction, it was ignored. However, in 5 patients there was demonstrable weakness of the anterior tibial muscle on the affected side and in 3 instances it was severe enough to produce foot-drop. Muscular fibrillations were noted in but 1 patient of this group.

In 15 of the 35 patients the ankle jerk was diminished or lost on the affected side, or in 43 per cent. Ten of these 15 patients had lesions at the lumbosacral joint and in the 5 others the lesion was at the fourth lumbar

interspace. This finding indicates a considerably greater incidence of diminished ankle jerk with herniated nucleus pulposus at the lumbosacral disk than at the fourth lumbar disk since 10 of the 13 cases involving the lumbosacral disk and only 5 of the 21 cases involving the fourth lumbar disk had diminution of the ankle jerk.

The knee jerk was diminished in 3 patients, 2 in which the herniation was at the fourth lumbar disk and 1 at the lumbosacral disk.

The total protein was determined in 16 patients. It was below 40 milligrams per cent in 4 instances and varied between 50 and 141 milligrams per cent in the remaining patients. In no patient was there an increase of cells in the spinal fluid.

Hypertrophy of the ligamentum flavum. Hypertrophy of the ligamentum flavum between the fourth and fifth lumbar laminæ or the fifth lumbar and sacral laminæ was found in 13 patients. Cases were reported as hypertrophy of the ligamentum flavum only when the histological examination coincided with the surgical opinion. One case of herniated nucleus pulposus was accompanied by a frank hypertrophy of the ligamentum flavum and the 2 lipiodol defects were shown clearly before operation. Other cases of herniated nucleus pulposus were associated with varying degrees of hypertrophy of the ligamentum flavum. Nine of the 13 cases of hypertrophied ligamentum flavum occurred in the first 30 cases of the series. This may have been partly coincidence, however, as was the occurrence of all 13 neoplasms in this same group. Ten patients were males and 3 females. Ages ranged from 16 to 57 years with an average age of 39 years. There was a history of definite trauma in 4 cases, questionable trauma in 2, and no trauma in 7.

The symptoms in 4 patients were initiated by sciatic pain, in 3 by low back and sciatic pain, in 3 by backache alone, and in 2 by pain in the posterior thigh. One patient had as his first complaint an ulcer on his heel. At the time of examination unilateral sciatic pain was the predominant symptom in 6, bilateral sciatic pain in 1. Back pain accompanied by sciatic pain was present in 1 patient. Pain was limited to the posterior thigh in 1 patient, the back, groin, and sciatic distribution in 1, the back alone in 1, and to the back and hip in 1 patient. Pain was present on coughing and sneezing in 10 patients, in 3 of which the Naffziger test was positive.

Slight difficulty with the urinary sphincter was noted in 3 patients, with incontinence of urine in 1. Libido was lost in 2 patients and diminished in 1. This contrasts with the much larger series of herniated nucleus pulposus in which neither libido nor sphincters were affected. The explanation is probably that hypertrophied ligamentum flavum is more frequently bilateral.

There was numbness of the affected leg or foot in 6 patients, of the buttocks in 1, and of both legs below the knees in 1. Of these only 6 showed hypesthesia or anesthesia: 2 in the perianal region, 2 in all the sacral segments of one side, and 2 in the anterolateral surface of the leg. Motor weakness was observed in the tibialis anterior in 1 patient and the extensor hallucis longus in 1. Two patients appeared to have some weakness of the leg muscles, but it was difficult to estimate because of the pain factor. The ankle jerk on the affected side was diminished in 3 patients, lost in 2, and the knee jerk was diminished in 2. Both ankle jerks were absent in 1 instance. The total protein was estimated in 11 cases in which it varied between 50 and 148 milligrams per cent.

Neoplasms. The 3 neoplasms found in this series consisted of a dermoid tumor in a man 59 years of age, a neurofibroma in a woman 55, and an epidermoid tumor in a boy 13. Pain in the back and sciatic distribution was the dominant symptom in each instance. The pain became progressively more severe and there was no history of remission. Pain was intensified by coughing and sneezing in 2 of the patients, 1 of whom had a positive Naffziger test. Perianal numbness and hypesthesia were present in 2 with no sensory disturbance in the third. There was no motor weakness demonstrated in any of these patients. The regional tendon reflexes were normal in 2 patients but in the third both ankle jerks were lost. Total protein was 170 milligrams per cent in the case of neurofibroma and normal in the 2 other patients.

Negative explorations. It is in this group that we consider a likelihood of having missed a herniated nucleus. The fact that most of this group were satisfactory surgical results does not invalidate this assumption because it seems quite possible that a simple spinal decompression, particularly if the posterior rim of the intervertebral foramen is removed, may afford relief of pressure upon a root from a small herniated nucleus.

In the negative group 5 of the 9 explorations were upon females. The ages ranged between 23 and 52 years with an average age of 38 years. There was questionable trauma in but 1 of the 9 patients. Pain occurred first in the back in 7 patients, in the sciatic distribution in 1, and in the perianal region in another. At the time of examination the pain was present in the back and hip in 4 patients, in the sciatic distribution in 2, in the back and sciatic distribution in 1, in the back, groin, and knee in 1, and in the back alone in 1 patient. Pain was exaggerated by coughing and sneezing in 7 of the 9 patients, but in only 2 was the Naffziger test positive. Localized numbness was referred to the calf and foot in 2 patients, to the lower extremity as a whole in 1, and to the perianal region in 1. Hypesthesia was found in all the sacral segments of 4 patients, in the perianal region of 1, and in the lateral aspect of the right leg and foot in 1. There was no motor weakness observed in any of these patients. The ankle jerk was diminished on the affected side in 2 patients and lost in 1. The knee jerk was decreased and both ankle jerks absent in 1 patient. The total protein of 4 patients was estimated, 1 being normal, and the 3 others being 45, 50, and 75 milligrams per cent, respectively.

SUMMARY OF DATA

Disability was more apparent in the cases of herniated nucleus pulposus and hypertrophied ligamentum flavum than in the negative group. Pain throughout the distribution of the sciatic nerve, although at times secondary in severity to back pain, was present in 88 per cent of the patients with herniated nucleus pulposus and hypertrophied ligamentum flavum while it was present in only 33 per cent of the negative explorations. It can, therefore, be said that in the great majority of instances low back pain indicates an intraspinal lesion only when accompanied by sciatic pain.

One useful differential sign becomes apparent from the statistical summary herein. In 60 per cent of the cases of herniated nucleus pulposus there was hypesthesia or anesthesia limited to the lateral aspect of the leg or foot or both. In contrast, the cases of hypertrophied ligamentum flavum and the negative group showed areas of hypesthesia elsewhere, but in only 15 per cent and 11 per cent, respectively, was hypesthesia limited to these areas. Localized hypesthesia or anesthesia in the lateral aspect of the leg or foot could not be expected in a larger percentage of cases of herniated nucleus pulposus since involvement of one root alone can not cause hypesthesia. However, well localized paresthesias occurred in many of the patients with single root involvement and are of real diagnostic importance.

In a small percentage of the patients with hypertrophied ligamentum flavum the probable lesion could have been predicted by the widespread signs of sacral root compression.

LIPIODOL INVESTIGATION

There can be no justification for lipiodol study of the subarachnoid space unless the patient has been subjected to a complete, careful, general examination and neurological study. Such a study would naturally include plain roentgenograms of the spine and pelvis. If the neurological examination strongly indicates the presence of an intraspinal lesion and if reasonable conservative methods have failed to bring relief of symptoms then, and only then, should lipiodol injection be resorted to.

Plain films of the spine were not available in some of our cases; therefore, a statistical review of these data is impossible. We may state, however, that narrowing of the intervertebral joint spaces has been present in a number of our patients with herniated nucleus pulposus but has by no means been a constant finding. Also, several patients have shown arthritis limited to the site of a herniated nucleus pulposus.

Fig. 1

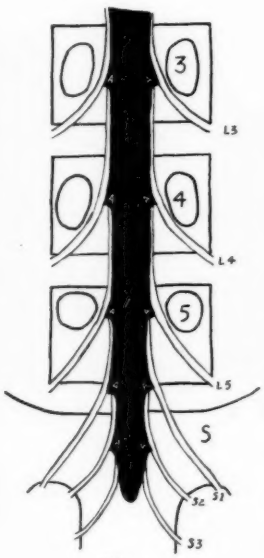

Fig. 2

Fig. 3

Fig. 1. Lipiodol defects quite typical of herniated nucleus pulposus are shown. The left-sided defect is located at the fourth lumbar interspace; that of the right, at the fifth.

Fig. 2. Representation of the relation of the thecal sac and lower lumbar and sacral nerves to the pedicles and intervertebral disks of the lower spine. The area usually filled with lipiodol is black and the "axillary pouches" are marked with "A." (After Hampton and Robinson.)

Fig. 3. This roentgenogram was taken with the patient in the prone position on a tilting fluoroscopic table. The lipiodol is not in the terminal sac as it would appear but has been balanced opposite the lumbosacral disk. There is slight deviation of the column to the right in its lower portion but far more remarkable is the absence of the axillary pouch of the fifth lumbar nerve on the left side. In this case herniated nucleus pulposus from the lumbosacral disk had occurred far laterally.

We have, on the other hand, observed a few patients with grossly narrowed joint spaces in whom complete examination, including the use of lipiodol, was negative for intraspinal pathology.

When the decision to use lipiodol has been reached it is injected at the time of the first lumbar puncture, after having made manometric readings and after having withdrawn a small amount of the fluid for cell count and total protein estimations. This is usually performed the day before the patient is to be fluoroscoped, because by so doing we have found the column to be smooth and show less tendency to spread into droplets than if the injection had been made just prior to the roentgenographic examination.

Two cubic centimeters of lipiodol, which is preserved in glass ampules, we believe quite sufficient for demonstration of any filling defects in the lower lumbar canal (Fig. 1). There are several theoretical considerations indicating that this amount of opaque oil is adequate. With the patient in a prone position the anterior wall of the spinal canal forms a trough for the passage upward and downward of the opaque material. Since the lumbar and sacral nerves leave the subarachnoid space well anteriorly, even this small amount of lipiodol fills the axillary pouches. Fortunately, the lesions involving either the ligamentum flavum or nucleus pulposus are prone to occur in the region of the third, fourth, and fifth lumbar interspaces. In this area the concavity of the canal with the patient prone is sufficient to keep the 2 cubic centimeters of lipiodol in a compact segment. By raising and lowering the fluoroscopic table this compact segment can be placed opposite any of the intervertebral disks at will.

It is true that with 2 cubic centimeters of lipiodol, bizarre distribution occurs as the head is lowered and the contrast medium passes opposite the upper 2 lumbar vertebræ into the thoracic region. In these areas the opaque material is no longer in a compact segment but is spread out to a length several times that which occurs in the lower lumbar canal. This spread is caused by the lipiodol resting first on a flat and then a convex surface rather than on the concave surface of the lower lumbar and sacral regions. For these same reasons a larger amount of lipiodol may form the same bizarre distribution.

We can conceive of but one condition in which larger amounts of lipiodol may be necessary for diagnosis, and that is the herniated nucleus pulposus which is displaced into the spinal canal only during weight bearing in the upright position. In such an instance, it would be an advantage to have sufficient lipiodol to fill the canal above the interspace in question so that roentgenograms could be taken with the patient standing.

On the other hand, larger amounts of lipiodol may obscure a small anterior defect unless it is observed just as the head of the advancing column reaches it. We have observed 1 patient in whom 2 cubic centimeters were sufficient to obscure a small defect when the column was compact and only when the column was thinned out by the changing positions were we able to visualize the lesion. In a number of doubtful cases we have injected an additional 2 cubic centimeters of lipiodol, making a total of 4 cubic centimeters. In no instance was it possible to demonstrate a defect more clearly than it had previously been demonstrated with the smaller amount.

Interpretation of the lipiodol examination may be very simple when the lesion is obvious and most difficult when the lesion is more obscure. Gross defects, of course, can easily be seen under the fluoroscope. However, the more deceptive defects can be demonstrated only with roentgenograms, preferably made as serial exposures. The clear-cut unilateral filling defect opposite a disk indicates a herniated nucleus pulposus. The defect of hypertrophied ligamentum flavum is more apt to be bilateral and opposite the vertebral body. In a few patients hypertrophied ligamentum flavum has caused narrowing of the terminal 3 to 5 centimeters of the sac rather than a typical "hour-glass" contraction.

Complete blockage to the passage of lipiodol may occur with any 1 of the 3 lesions described, the blockage, of course, being entirely due to the size of the mass within the spinal canal.

The failure of 1 axillary pouch to fill with lipiodol may be the only positive evidence of an intraspinal lesion (Figs. 2 and 3). Operation was performed in 7 instances because of an absent axillary pouch. In 3 patients a herniated nucleus pulposus was found but in 4 the exploration was negative. Three of the 4 negative explorations did not have characteristic histories and findings of an intraspinal lesion, but the 3 positives had perfectly classical symptoms and signs. Therefore, it is most important before interpreting such a minor lipiodol defect to have a clear-cut clinical picture to corroborate it.

SURGICAL TECHNIQUE

The usual midline incision is made from the spinous process above to the second spinous process below the level of the suspected lesion. Identification of the exact level in the lower lumbar canal is often difficult and it is most helpful to include in the incision the spinous process of the first sacral vertebra. Hemilaminectomy is performed over the lipiodol defect provided that both the pain and the defect are unilateral. If a greatly thickened ligamentum flavum is discovered, the bony exposure is carried to the opposite side in order to remove it completely. Even with unilateral laminectomy it is not necessary to disturb the articular facets because by dissecting the ligamentum flavum beneath the lateral margin of the lamina sufficient exposure of the anterior neural canal for the removal of the lesion is easily accomplished.

When the lesion is exposed incision is made in the posterior longitudinal ligament just sufficiently large to remove the pulpy herniated material. In many instances, spontaneous extrusion of the material occurs. In others it is necessary to tease the mass out of

Fig. 4. The fourth lumbar root on the right is swollen and projects from its foramen in an abnormal manner. This may be the only evidence of root compression laterally in the intervertebral foramen.

the incision. After the herniated material has been removed the opening into the intervertebral disk can readily be entered with a pointed instrument. If the rent is a large one, the pituitary rongeur is frequently introduced into the interior of the disk and the remainder of the nucleus pulposus removed as thoroughly as possible. In several instances we have found the herniated nuclear material to have dissected beneath the posterior longitudinal ligament upward or downward, and when exposed at operation the mass was present not at the intervertebral disk but over the vertebral body.

We have found it possible in almost every instance to remove these lesions extradurally even when the dura has been opened to identify and localize the lesion. The danger of arachnoidal adhesions after the intradural manipulation is a real one, and in 1 of our patients disabling symptoms have persisted because of them. Another important reason for not opening the dura is that should a wound infection occur the likelihood of meningitis is greatly reduced.

It is true that by not opening the dura examples of choked root (Fig. 4) may not be observed but this is of no consequence if the lesion has been identified. In some of the earlier cases a swollen root projecting at an angle quite different from that of the opposite side has led to the discovery of the lesion far lateralward. The mechanism of this root engorgement is probably the same as in choking of the optic disks, namely, compression of the veins accompanying the nerve.

It is necessary at times to expose the intervertebral foramen in order to remove a lateral herniation of the nucleus pulposus. These lateral herniations protruding into the intervertebral foramen are the most difficult to identify and, as a consequence, are most likely to be overlooked by the operator. The presence of a choked root is a most reliable guide to this probable location.

In conclusion, we believe that the best results will occur when the bone removal has been minimal, when the articular facets have not been disturbed, and when the lesion has been removed extradurally.

ANESTHESIA AND POSTOPERATIVE TREATMENT

Forty-six of the 60 patients were operated upon under procaine hydrochloride infiltration and block anesthesia. Pentobarbital sodium, 0.2 gram was given orally 1½ hours before the operation was started. One hour before the operation .002 gram of dilaudid and .004 gram of hyoscine hydrobromide were given hypodermically. Frequently, half the dose of dilaudid and hyoscine hydrobromide was repeated as the incision was made. This gave a satisfactory "twilight" state so that the patients remained quiet under local anesthesia. Frequently, it was necessary to infiltrate a single root in its dural sleeve during removal of the ligamentum flavum or the herniated nucleus pulposus from beside or beneath it. On several occasions a small amount of spinal procaine hydrochloride (0.025 to 0.050 gram) was placed intrathecally in order to avoid pain from extensive manipulation of the roots. When intrathecal administration is necessary, the subarachnoid space is always blocked above with a cotton pledget to prevent upward diffusion of the procaine. Patients operated upon in this way stand the operation remarkably well. They

are able to take fluids after operation so that parenteral fluid administration has rarely been necessary. None of the patients have had a very unpleasant recollection of the operation.

Nine patients were operated upon and an average of 90 cubic centimeters of ether and 100 cubic centimeters of olive oil was used rectally. It was necessary to use the same local infiltration with 1 per cent procaine hydrochloride as was true with "twilight sleep." This was very satisfactory in all patients except 1 in whom unusual complications occurred which will be described later.

In 3 patients operated upon we used tribromethanol (avertin), 80 milligrams per kilogram, in amyelene hydrate rectally together with local infiltration of procaine hydrochloride. There was 1 bad result in this group which will be described later. Two operations were satisfactorily performed under spinal anesthesia. It is our conviction that these patients can be operated upon most safely with "twilight sleep" supplemented by local infiltration with procaine hydrochloride.

Following laminectomy the patients are kept flat on their backs for the first 8 hours and then are turned regularly every 2 hours. A specially resilient hair and rubber mattress has been found more satisfactory than the usual inflated air mattress. The diet is increased as tolerated. For pain during the first 2 or 3 days .002 gram of dilaudid is given, after which it is no longer necessary. Routinely, patients sit up in bed on the tenth postoperative day, sit in a chair on the eleventh day, and are usually discharged on the twelfth to fourteenth day after operation. In rare instances it was necessary to catheterize patients for from 1 to 3 days. The incidence of this complication, however, was no more frequent than after any major surgical procedure. Catheterization has been avoided completely in recent cases by the administration of 0.00012 to 0.00025 gram of carbaminoylcholine chloride (Doryl) before the bladder has become overly distended, resulting in prompt evacuation. In those patients in whom the back has been weakened appreciably by an extensive removal of bone, especially if the patient is a manual laborer, or if the annulus fibrosus is badly disrupted, a Williams' low back brace is fitted before the patient leaves the hospital and is worn constantly except when in bed. The brace is usually discarded after 2 months.

PATHOLOGY

Herniated nucleus pulposus. Mauric has aptly compared the intervertebral disk to one of the more mobile joints. The laminæ of cartilage applied to the faces of the vertebra are the articular surfaces, and the annulus fibrosus is the tough joint capsule. Although the space containing the nucleus pulposus is not lined with synovial membrane, it corresponds functionally to the joint cavity with the nucleus pulposus loosely attached within. All motion takes place by movements of the cartilaginous laminæ in relationship to each other and to the nucleus pulposus.

Histologically, it is easy to differentiate these 3 structures of the disk. The cartilaginous laminæ are true hyaline cartilage. The annulus fibrosus is composed chiefly of dense parallel connective tissue bundles, interspersed with bits of fibrocartilage. The nucleus pulposus is not uniform throughout. In its interior are fine fibers interlacing in all directions with a few islands of cartilage cells. At the periphery the fibers become more concentric in arrangement so that there is a transition to the structure of the annulus fibrosus.

The surgical specimens of herniated nucleus pulposus stained with hematoxylin and eosin show a characteristic structure much like that of the normal nucleus pulposus. The sections stain a pale blue or purple and show the presence of many interlacing, fine fibers running in all directions. Cells are of the type found in cartilage, usually sparse, but placed in groups of from 2 to 6. The nuclei are rounded, take a uniform deep blue stain, and are surrounded by a moderate amount of clear cytoplasm. Frequently many of the nuclei are degenerated.

We believe that significant protrusion of the intervertebral disk into the neural canal is almost always due to herniation of the nucleus pulposus even when the annulus fibrosus has been severely disrupted. Nuclear material was found in all of our surgical specimens but

was accompanied in 5 instances by torn fragments of the annulus fibrosus. We believe, therefore, that the term "herniated nucleus pulposus" is the proper designation for this clinical and pathological entity.

Hypertrophied ligamentum flavum. The ligamentum flavum is probably damaged by injuries similar to those affecting the annulus fibrosus. At operation the normal yellow ligament may be found replaced by white connective tissue making it several times the thickness of the normal ligament which is found above and below the hypertrophied area. The thickened ligament may be partially calcified.

Microscopically, the occurrence of scarring is easily apparent. In addition, there has been in many cases a low grade inflammatory reaction in the ligamentum flavum. An apparently thickened ligament should not be considered "hypertrophied ligamentum flavum" unless the microscopic examination shows scarring.

Neoplasms. The diagnosis of dermoid tumor was based upon the finding of a caseous mass filled with hair lying in the cauda equina. The specimen did not include the nodule from which this must have arisen. Possibly the nodule was farther down in the sacrum in an area unexposed at operation. There was no true attachment of the mass to the nerve roots among which it was found.

The epidermoid tumor was diagnosed grossly from the typical pearly-gray, laminated débris contained in a thin membrane. Microscopically, the membrane was composed of cornified, stratified, squamous epithelium without dermal elements.

The third tumor presented parallel bundles of fibers with elongated, deeply staining nuclei interspersed, frequently in palisade formation, characteristic of a neurofibroma.

RESULTS

Herniated nucleus pulposus. The immediate result in 26 of the 35 cases of herniated nucleus pulposus was excellent. The improvement was slow in 7 cases but with definite relief of the more severe pain which had occurred before operation. One patient died too soon after operation to judge whether or not there was any relief, and 1 patient, who was relieved completely of his pain, died on the twelfth postoperative day. The final result in 26 of the 33 surviving patients, who have remained entirely free from pain, was excellent. There was some residual weakness of the anterior tibial muscle in 2 instances in which pain was completely relieved. Three patients were relieved of their most severe pain but continued to have some residual pain in the back although free from the sciatic pain which was present before the operation. One patient, who had been relieved immediately following the operation and remained so for a period of 2 or 3 months, again gradually developed severe pain through the perianal region and the lower extremities. When this patient was re-explored arachnoidal adhesions were found to have caused a complete block of the subarachnoid space at the site of the previous operation. One patient has been entirely relieved except for 2 attacks of severe back pain, each lasting 1 week. This patient also has slight residual weakness in the anterior tibial muscle but is entirely free of his old sciatic pain. One patient returned 3 months after operation with sciatic pain in the opposite leg, despite the fact that a hemilaminectomy was performed and the dura was not opened. He was completely relieved of symptoms on the side operated upon.

The longest postoperative period through which a patient has been followed is 18 months, the shortest 6 months. It is apparent, therefore, that the eventual results may not be the same as they appear at present.

Hypertrophied ligamentum flavum. In the hypertrophied ligamentum flavum group, consisting of 13 patients, the immediate result was very satisfactory in 9 instances. One patient died from meningitis following operation. Of the surviving 12 patients, 8 recovered completely, and 4 have slight residual pain but are much improved over their preoperative state. The longest postoperative period in this group is 2½ years, the shortest 6 months.

Neoplasms. Two of the patients of this group recovered completely and have remained well. The third continues to have mild discomfort in the region of the sacrum,

presumably due to incomplete removal of the dermoid tumor.

Negative explorations. Four of the 9 patients of this group were relieved almost immediately by the operation and 4 more have slowly improved. Six of the 9 patients are at present free from symptoms, 2 are moderately improved, and in 1 case there has been no modification of the patient's severe back pain.

It is necessary to go into considerable detail in the 9 negative explorations in order to emphasize the points by which they may have been predicted. In 3 instances only was there a filling defect to lipiodol. In one of these it was attributed after operation to the straightness of the lumbar spine which tends to make possible the appearance of spurious defects in the lower canal comparable to those normally seen higher up (Fig. 5). In 4 cases there was an asymmetrical or absent axillary pouch. The lipiodol examination was omitted in 1 patient following its extradural administration. In 1 case exploration was done in the face of a negative fluoroscopic examination because of the typical sciatic pain, absent ankle jerk, and hypesthesia of the lateral aspect of the calf. Careful exploration in this case revealed nothing more than an extremely large plexus of veins about the first and second sacral root sleeves on the painful side. The other patients in this group had symptoms and findings typical of herniated nucleus pulposus, namely, typical sciatic pain, diminished ankle jerk, and hypesthesia of the lateral aspect of the calf and foot. In 1 of these 2 patients there was lumbarization of the first sacral vertebra on the painful side, with fusion on the non-painful side, but with an intervertebral disk between the first and second sacral vertebræ. When no herniated nucleus pulposus was discovered, it was thought probable that the compression might be in the bony foramen because of the congenital anomaly. For this reason the dura was opened and the posterior root of the first sacral nerve separated and divided. This has resulted in a complete recovery.

It seems reasonable to assume that in some of the negative explorations, when typical symptoms of herniated nucleus pulposus were present, relief was obtained by removing a normal ligamentum flavum, thus decompressing the nerve roots which were impinged upon. This is especially apt to be the case when the herniation is of the type which is reduced by the prone position and compresses the nerve roots only when the spine bears weight. It is feared that in this type of case symptoms are apt to recur.

Fig. 5. Lipiodol is shown balanced across the fourth lumbar interspace in a figure resembling an hour-glass. This patient showed at operation a rather prominent intervertebral disk but no true herniation. This broad bilateral defect does not indicate an intraspinal lesion.

Fatalities. There were 3 deaths after operation in the 60 patients operated upon, or 5 per cent. All 3 deaths occurred in patients in their sixtieth year or older. One patient died on the fifth day following operation as a result of meningitis following a wound infection. One patient had a long-standing cardiovascular disease before operation and a mild hemiparesis. He developed a complete hemiplegia after operation, succumbing in 48 hours. He had been given tribromethanol, 0.080 gram per kilogram in amyelene hydrate rectally, and local anesthesia. A man 60 years of age, who had had no previous colonic disorder was given rectal ether, namely, 90 cubic centimeters of ether in 100 cubic centimeters of olive oil before operation. In addition, local anesthesia was administered for

the operation. After the operation was completed the large bowel was irrigated with saline to remove any of the ether and olive oil mixture which might have remained. During the first 10 days following the operation he complained of abdominal discomfort and gas. Then it became evident from the abdominal distention that a serious intra-abdominal complication was present. He died on the twelfth day and it was found at postmortem examination that the large bowel from the middle of the transverse colon to the anal canal was gangrenous, containing as many as 50 perforations through which the finger could be passed.

Elderly individuals, particularly those with complicating diseases, were operated upon only when completely incapacitated. The increased risk which the operation carried was explained to each patient and his family, and only in those patients in whom the pain was so severe that they were willing to accept the additional risk was the operation carried out.

DISCUSSION

In nearly all the cases of herniated nucleus pulposus or hypertrophied ligamentum flavum pain has been the disabling factor. Pain in the whole sciatic distribution has been the most useful symptom diagnostically; yet a number of proved cases have had pain limited to the back, gluteal region, or posterior thigh. Other patients have shown incapacitating backache recurring over a period of several years before a true "sciatica" occurred. If a herniated nucleus pulposus was present throughout the entire period, it is surprising that leg pain was the last occurrence. Mauric has suggested that the herniation probably occurs gradually over a period of months or years, giving a characteristic "sciatica" only when it is complete. This conception corresponds to some of the partial herniations we have seen at operation. Perhaps it would be more logical to suggest that the herniation proceeds in stages, a small additional amount of nucleus pulposus being herniated at intervals, giving the intermittent history so characteristic of this clinical entity. Certainly many patients with complete anesthesia in the first and second sacral dermatomes have pain which is much more severe in the gluteal region or posterior thigh than in the leg. In our experience paresthesias as well as pain have preceded anesthesia in these dermatomes, and in rare cases the most severe pain has been referred to the dermatomes corresponding to the root involved. But as a rule this expected sequence is not observed. The roots which are found involved by herniated nucleus pulposus or hypertrophied ligamentum flavum of the fourth or fifth interspace are the fourth (Fig. 6) and fifth (Fig. 7) lumbar and first and second sacral and perhaps the third, fourth, and fifth sacral. While these roots supply dorsal divisions to the gluteal region, their dermatomes are essentially below the knee with the exception of the second sacral nerve which also supplies the posterior thigh.

Barr concluded that the referred pain from herniated nucleus pulposus has no obvious relationship to the sensory dermatomes. Many of his patients, at least 90 per cent, had pain in the posterolateral calf. We are of the opinion that this readily agrees with the frequent involvement of the first and second sacral nerves, usually at the lumbosacral disk, but also at the fourth lumbar disk in some instances. As Foerster has pointed out, the involvement of a single root does not produce anesthesia. In those cases with only one root involved, a part of the pain or paresthesia complained of is usually in the dermatome corresponding to the involved spinal nerve. Over two-thirds of our cases of herniated nucleus pulposus have had hypesthesia or anesthesia of the lateral calf, corresponding probably to involvement of the first and second sacral nerves.

In regard to the production of pain by a herniated nucleus pulposus there arises the question upon what factors the pain depends. In one patient paralysis of the anterior tibial muscle preceded pain. We have observed 2 patients in whom sciatica of severe degree was terminated at the appearance of an enduring foot-drop years before. A far more common occurrence is the absence of the ankle jerk after a "sciatica" has ceased to cause pain. When true neuritis subsides, the reflexes, as a rule, return. Therefore, these

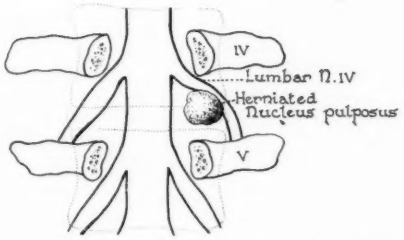

Fig. 6. The nucleus pulposus has herniated from the fourth lumbar intervertebral disk far laterally to compress the fourth lumbar nerve. Such a protrusion does not indent the dura but may cause a choked root.

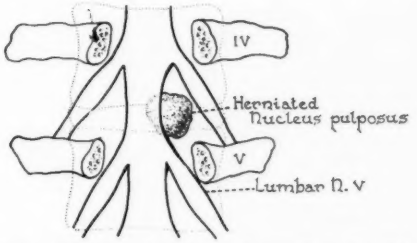

Fig. 7. A herniated nucleus pulposus from the disk between the fourth and fifth lumbar vertebræ has compressed the thecal sac on the right. The fifth lumbar nerve is compressed intrathecally in this instance.

cases of subsidence of an enduring "sciatica" with residual neurological findings indicate the possibility of painful disability from a herniated nucleus pulposus disappearing with complete physiological destruction of the involved nerve.

There are several possible ways of explaining the intermittency of symptoms from herniated nucleus pulposus or hypertrophied ligamentum flavum. A herniated nucleus pulposus is usually situated dorsal to at least a part of the intervertebral disk. We know that it may shift its position beneath the posterior longitudinal ligament because we have observed such shifts at the operating table. It seems probable that a herniation may be reduced by being squeezed back into its original site only if the anatomy of the disk is very grossly altered. Also, without a shift of the displaced nucleus the impinged nerve roots might readjust their position over its glistening surface. One must consider also the possibility that further trauma to already traumatized nerve roots may render them temporarily incapable of conducting painful impulses.

Deucher and Love, in 1938, have described edema of the protruded portions of the intervertebral disks which they feel may cause the intermittent symptoms characteristic of this condition. In the examination of our surgical specimens from the intervertebral disks edema was not considered a prominent feature. Osteopathic or chiropractic manipulations which have undoubtedly given temporary relief to several of our patients, may well do so by one of these mechanisms.

It appears worthwhile to attempt to explain the distribution of pain in the usual case of herniated nucleus pulposus or hypertrophied ligamentum flavum with pain in the back, gluteal region, posterior thigh, and leg. It seems highly probable that the initial pain in the back, occurring at the time of injury, was due to tearing of either the annulus fibrosus or the ligamentum flavum, or both. Continued pain in the back is probably due to local stimulation of pain fibers in the region of the lesion, possibly to distention of the small defect in the annulus fibrosus through which the nucleus pulposus is being extruded. As Goldthwaite commented, a thin disk may change the relationship of the articular facets and produce pain by so doing. Since the involvement of a single nerve (usually fifth lumbar or first sacral) by a herniated nucleus pulposus at the fourth or fifth lumbar interspace may cause pain in all the areas mentioned, the explanation must be adequate for this situation. A simple explanation lies in the multiple sensory innervation of the sacrospinalis, gluteal, hamstring, and leg muscles by the fifth lumbar and first sacral nerves. In contrast, the ileopsoas, quadriceps, femoris, and adductor groups receive no innervation from these nerves and are never painful in lesions of the disks or ligaments at this level. In addition, there is no way of excluding the overflow of painful stimuli into segmentally adjacent spinal nerves. If the sensory portion of the posterior divisions of these nerves is involved, pain or paresthesias should be referred to the small dermatomes about the gluteal region.

Naffziger, Inman, and Saunders have recently made an important contribution on the mechanisms involved in the production of herniation of the nucleus pulposus and hypertrophy of the ligamentum flavum. These authors emphasize the deficiency of the posterior longitudinal ligament, especially laterally where the disk comes into relationship with the intervertebral foramen. Another factor mentioned is the normal location of the nucleus pulposus in the lumbar region a little dorsal to the center of the disk with movement farther dorsally in flexion of the lumbar spine. The intimate relationship between the ligamentum flavum and nerve root is clear since the ligamentum flavum and intervertebral disk form a groove occluding the lower one-half of the bony intervertebral foramen. The limitation of rotation in the lumbar region causes lateral flexion to occur when rotation is attempted. This places the major stress upon the posterolateral portion of the annulus fibrosus and the ligamentum flavum of the contralateral side. These authors have seen patients who felt a sudden snap in the back at the time of a probable rupture of the ligamentum flavum. It is the subsequent repair which causes hypertrophy of the ligamentum flavum with encroachment upon the intervertebral foramen.

It is surprising that the articles dealing with one aspect of low back pain and "sciatica" rarely mention the other aspects, although from the symptomatology the cases doubtlessly come within the same group. Anomalies of the lower lumbar and sacral spine doubtlessly cause incapacitating symptoms at times. But they are observed so frequently as coincidental findings in the absence of symptoms that their presence in particular instances should not be invoked too readily to explain the disability. Excellent descriptions of such anomalies are given by Wagner and by Clarkson and Barker. It is necessary to emphasize that anomalies of the lumbosacral spine may be accompanied by weakness of the annulus fibrosus or ligamentum flavum. Also due to the altered mechanism, predisposition to herniation of the nucleus pulposus or tearing of the ligamentum flavum with subsequent hypertrophy may well exist.

There is so little evidence that fascial contractures exist primarily, except perhaps in very unusual cases, that they can be dismissed as common causes of low back pain and sciatica. On the other hand, Freiberg believes that the anatomical situation of the sciatic nerve between the pyriformis muscle and the sciatic notch is similar to the position of the brachial plexus in the scalenus angle. He indicates that the relief in these cases afforded by section of the pyriformis muscle or the fascia lata tends to prove this point. In this connection it is interesting that many cases of tuberculosis and metastatic carcinoma of the cervical spine show characteristic symptoms and signs of scalenus neurocirculatory compression (11), including scalenus tenderness and reproduction of pain and paresthesias by pressure over the scalenus anticus muscle. These patients, of course, have been treated etiologically rather than with anterior scalenotomy. However, it seems probable that the amelioration of symptoms in cases of low back and leg pain which have been subjected to section of the ileotibial band or the pyriformis muscle might be analogous to a scalenotomy in such a case. There is no denying temporary improvement following this procedure in a moderate percentage of cases, but in our experience the symptoms have recurred; and after lipiodol studies indicated the location of the lesion, a herniated nucleus pulposus or hypertrophied ligamentum flavum was surgically verified and removed. Barr reports that 2 of his patients with surgically treated herniated nucleus pulposus had previously been relieved for 12 months and 2 months by fasciotomy. Five of our patients had previously been subjected to fasciotomy but only 1 of them obtained even temporary relief of symptoms.

Ober in reporting 13 cases of fasciotomy with relief in 12 instances makes this statement: "Before the surgeon does this operation, he should be very sure that there is no pathologic condition in the spinal canal, especially in the region of the cauda equina." Since his cases are clinically identical to many that have been proved to be herniated nucleus pulposus it is clear that the only way in which the surgeon can rule out intra-

spinal etiology is by fluoroscopic studies utilizing intraspinal lipiodol. If conservative treatment or fasciotomy gave lasting relief in cases of herniated nucleus pulposus, laminectomy would probably be replaced, even though the treatment would not attack the etiology. However, our experience indicates that lasting relief of pain can be obtained only by removal of the actual intraspinal pathology.

Smith-Petersen explains the frequent radiation of pain from the lumbosacral joint to the dermatomes of the fifth lumbar and first sacral nerves by the fact that the lumbosacral joint receives its innervation from these 2 spinal nerves. This radiation of sciatic pain is, again, highly suggestive of herniated nucleus pulposus. That the pain of herniated nucleus pulposus or hypertrophied ligamentum flavum may be relieved temporarily in many instances by operations directed toward the fasciæ, the sacro-iliac joint, the lumbosacral joint and its articular processes, or by traction or immobilization of the lower spine, seems highly probable. It appears, however, very unlikely that these measures will bring about enduring relief. The solution appears to be in subjecting this entire group of patients to lipiodol studies provided that disability is sufficient to justify an operative procedure.

SUMMARY AND CONCLUSIONS

1. Of the 3 pathological conditions described in this paper, herniated nucleus pulposus is by far the most frequent. While the true incidence of this condition is as yet unknown, the occurrence of 35 cases during the same period in which 3 tumors of the cauda equina were observed indicates its probable frequency.

2. The diagnosis of herniated nucleus pulposus or hypertrophied ligamentum flavum must be made clinically as well as roentgenologically to assure successful selection of cases for operation.

3. The use of 2 cubic centimeters of lipiodol intraspinally is a safe procedure and the amount is adequate for diagnosis.

4. Lesions low in the spinal canal are the commonest single cause of recurrent or chronic low back and sciatic pain in that group of patients in whom no bony disease of the lower spine or pelvis is demonstrated.

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TRAUMATIC ENOPHTHALMOS

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AMONG the uncommon effects of head injuries few are perhaps more striking than traumatic enophthalmos. Ordinarily its infrequent occurrence and peculiar progress is sufficient to arouse the interest and curiosity of any examiner first encountering a case for diagnosis. Such was found to be true in the presented examples of this unusual condition.

As early as 1893 Schapringer called attention to the fact that cases of dislocation or violent backward displacement of the eye should be distinguished from those of true enophthalmos or recession of the eye following an injury. Although presuming that many more cases of traumatic enophthalmos of varying degree have occurred than have been reported, its relative infrequency is shown by the fact that at the time of his paper in 1902, Kilburn was able to collect a total of only 51 cases. In a comprehensive article on the subject in 1906, Lukens gathered together 78 cases to which he added 1 of his own. Hartung tabulated 14 cases of traumatic enophthalmos among 50,000 patients in the ophthalmic clinic in Jena, while in the Leipzig Clinic of 150,000 admissions, the condition was observed only 4 times. In 1930, Birch-Herschfeld was able to collect 164 cases from the literature. He mentioned that Pichler had seen not less than 28 cases during 3 years of the world war; Wagenmann had discovered 14 cases over a period of 10 years, and he himself had observed 5 cases during a period of 3 years.

REPORT OF CASES

CASE 1. Recession of the left eye occurring a year following an automobile accident 13 years previously, slowly progressive since that time. Left frontal headaches and occasional blurring of vision of the left eye for the last 2 years.

The patient, Mrs. J. D. K., aged 29, was referred by Dr. L. E. Brown, of Corona, California, because of slowly progressive recession of the left eye for 13 years, together with left frontal headaches, and blurred vision of the same eye for the last 2 years. Her subsequent history revealed an automobile accident sometime in 1924 which resulted in no loss of consciousness, no bleeding from the ears or nose, and no apparent sequelæ other than the condition which brought her for examination and diagnosis. As far as the patient could remember, it was a year or more after the accident that she first realized her left eye appeared more deeply set than the right. Since then the recession has slowly but progressively increased. About 2 years ago for the first time a dull, throbbing headache occurred in the left frontal region, which has since returned about twice a month. The duration of this headache has varied from 2 to 3 hours to the entire afternoon. During the past 2 years she has also noticed some blurring of vision in the left eye lasting usually about 1 to 3 hours. This she has felt has not had any particular relation to her headaches. No nausea or vomiting has been associated with her illness. No relative has ever had a similar condition and the family history was otherwise without significance.

The patient's general health has always been good. She has been married 8 years. Her husband, and 2 children, a girl of 7 and a boy of 3, are living and well. Her blood Wassermann was negative and a review of the systems was found to be non-contributory.

Examination revealed a woman 5 feet 5¼ inches tall, weighing 130 pounds, who appeared to be in good physical condition. About 4 centimeters to the left of the midline in the frontal region a linear scar about 6 centimeters in length was observed extending upward from the eyebrow toward the hairline. This gave the appearance of an old laceration (Figs. 1 A and B). It was not particularly painful nor sensitive to pressure. Strangely enough on further questioning concerning this, the patient was unable to recall that it had occurred as a result of her injury. In comparison with the right, the left eyeball was markedly receded and seemed higher in the socket. A slight ptosis was noticeable and the left eye had the suggestive appearance of an artificial eye. There also appeared to be some atrophy of the infra-orbital region, particularly toward the nasal side (Fig. 1). The contours of the head were otherwise normal and no areas of tenderness were noted. The general physical examination revealed nothing of importance.

Examination of the cranial nerves disclosed nothing of pathological interest. She recognized camphor in each nostril. Both optic discs were clearly seen, were normal in color, and showed no evidence of papilledema. The vessels appeared normal in caliber and no hemorrhages or exudates were seen.

The uncorrected vision of the right eye was 20/30 and the left 20/40. The pupils were circular and equal and reacted well and equally to light and accommodation. The extra-ocular movements were well performed, there was no nystagmus, squint, or diplopia. Both corneal reflexes were found to be equal and active, and no motor or sensory disturbances were made out. Similarly, normal performances were elicited from the remaining cranial nerves. No constriction of the visual fields was found on rough testing and further perimetric examination with the Bjerrum screen confirmed these findings. The remaining neurological examination revealed nothing of a pathological nature.

Roentgenograms of the skull with special reference to the optic foramen were taken by Dr. R. G. Karshner. They failed to reveal any demonstrable intracranial abnormality. The optic foramina were well shown and equal. The sella turcica was rather small and of the somewhat closed type.

There are features of this case not unlike those of progressive facial hemiatrophy which will be considered in the discussion.

CASE 2. Laceration over left eyebrow 3 years previously when he was hit in this region by a bottle. Patient has not noticed any particular difference in the position of the eyeball.

The patient, Mr. V. P. M., aged 44, injured his left eye some 3 years previously, when he was struck over this region with a beer bottle, which resulted in momentary loss of consciousness and a laceration above the left eyebrow requiring 5 stitches. The patient is of the opinion that he has not seen as well with this eye since the injury, but has not observed any particular difference in the position of the eyeball. He was knocked unconscious for about an hour as a result of an automobile accident during January of 1937. There were no hemorrhages from the ears, and x-ray films failed to reveal evidence of a fractured skull. About 2 or 3 months following the injury a tremor of the right arm and shoulder appeared which has persisted. Diplopia, which was noticed immediately after the accident, gradually cleared up with the exception of persisting for upward gaze. He has not suffered with headaches nor has he complained of dizziness. At times he has some shaking of his right leg. He has been unable to walk, but has been able to stand by holding on for support. His general health has always been good. A review of his family and past history disclosed nothing of importance. The blood Wassermann was found to be negative.

On examination the patient exhibited a rhythmical tremor of the right upper extremity most marked about the shoulder but affecting the entire arm. No typical pill-rolling effect was observed. His features though rather expressionless were not definitely mask-like. The tremor of the hand was not found to be diminished with use. The left eyeball was noticeably sunken in the socket as compared with the right. A scar was observed about midway in the upper eyelid crossing the supra-orbital region and extending about 3 centimeters into the forehead (Fig. 2). There seemed to be no increase and no difference in the intra-ocular tension of the 2 eyes. Both pupils reacted sluggishly to light, the left more than the right. They reacted well to accommodation; there was no diplopia and no observable squint, and both fundi appeared normal. The watch tick was heard at a distance of 4 inches from the right ear, and only when pressed against the left ear. Bone conduction was better than air conduction on the right side and air conduction better than bone conduction on the left. The Weber was not referred. The cranial nerves were otherwise found to be normal. Co-ordination tests could not be carried out well, but it was noticed that his tremor did not stop during the performance of the finger to finger or finger to nose tests. The Romberg and gait were not tested as it was evident he could not stand in the Romberg position and was not able to walk without support. There was a strongly suggestive Babinski bilaterally. The deep reflexes were found to be equally active. The vasomotor reaction was markedly increased. The patient's cerebration was generally slow and his insight poor.

Fig. 1. Case 1. A, left, Front view of patient showing the scar crossing the left eyebrow into the frontal region and the enophthalmos of the left eye. B, Partial side view of the same patient.

It was felt that the patient had developed a Parkinsonian type of tremor of the right upper extremity with a paresthesia of this extremity and hand suggestive of a thalamic lesion. It was assumed that most of his symptoms were of a posttraumatic nature. The recession of the left eye was believed typically that of traumatic enophthalmos, due in all probability to his first injury.

CASE 3. Automobile accident 3 months previously in which patient struck her left frontal region on the

A B

Fig. 2. Case 2. A, Front view of patient revealing somewhat indistinctly the scar running from the left upper eyelid into the forehead. The recession of the left eyeball is not well shown in this view. B, Right and left side views of the same patient. The scar is more noticeable and likewise the enophthalmos. In this view the prominence of the left external angular process is evident.

dashboard. Momentarily unconscious. Laceration through left eyebrow and comminuted fracture involving the anterior wall of the frontal sinus. Recession of the left eyeball noticed about 1 month later. Aneurism of the left external carotid artery, traumatic.

The patient, Mrs. W. J. L., aged 37, injured her left eye and frontal region August 1, 1938, in an automobile accident in which her head was thrown against the dashboard. She was knocked unconscious for a few minutes and was dazed for a short time thereafter. She was nauseated, vomited a few times, and had some headache. Examination at the Los Angeles County General Hospital revealed a severe hematoma of the left frontal region with swelling and ecchymosis of the lids of both eyes, the left being more pronounced. There was also a hematoma near the outer canthus of the left eye as well as subconjunctival hemorrhage. In addition there was a deep and jagged laceration running perpendicularly from the left eyebrow into the forehead for a distance of about 3 centimeters. An underlying fracture line was felt when this was probed. Shortly after the accident the patient complained of a constant buzzing, throbbing sensation in the left temporal region. Following her discharge on August 8, 1938, she was readmitted September 18, 1938, because of the continuance of this throbbing, buzzing sensation. For a week prior to her admission she had had some frontal headache, but no nausea, vomiting, or dizziness. Auscultation of the skull over the left temporal region revealed a definite bruit. This could be stopped by pressure over the left carotid artery. Roentgenograms of the skull taken September 20, 1938, showed a comminuted fracture involving the anterior wall of the frontal sinus which included depression of this bone at its suture with the nasal bone. The nasal bones were also fractured with depression of the adjacent portion of the frontal bone. A basal view of the skull taken on September 22, 1938, revealed both jugular foramina, but showed no evidence of erosion due to aneurism. Roentgenograms of the optic foramina taken October 6, 1938, were found to be negative. Blood and spinal fluid Wassermann tests were negative. Examination of the visual fields showed them to be essentially unrestricted, and the uncorrected vision of each eye was 20/20 on the right and 20/40 on the left. The fundi appeared normal and the remaining cranial nerves revealed no abnormalities. The general neurological and physical examination was essentially negative.

The slight enophthalmos of the left eye was noticed first on September 26, 1938, and seemed to become slightly more pronounced during her further stay in the hospital (Fig. 3). Parenthetically it may be stated that when the patient's attention was called to a possible difference in the prominence of her eyes she immediately said that she had noticed her left eye was "sinking." She was very positive on this point.

Examination of the eyes revealed a definite recession of the left. This was emphasized by the scar in the eyebrow and forehead and the apparent undue prominence of the external angular process (Fig. 3). There was no noticeable difficulty with the extraocular movements of the eye. No visual disturbances were present. Both pupils were circular and equal. They reacted normally to light and distance.

Daily pressure on the left common carotid artery was carried out and on October 31, 1938, this vessel and its branches were exposed. Occlusion of the internal carotid failed to alter the bruit but occlusion of the external completely abolished it. The external carotid was consequently ligated, with disappearance of the bruit.

As far as we can demonstrate this is the only case that showed fractures in the vicinity of the orbit. It is entirely possible that Cases 1 and 2 may have had fractures which subsequently healed. We feel that the enophthalmos and the intracranial aneurism in this in-

A B

Fig. 3. Case 3. A, Front view of patient which demonstrates the scar in the left eyebrow and forehead and the prominence of the left external angular process. The enophthalmos is not well visualized in this view. B, Right and left side views of the same patient. The enophthalmos is more evident in this view.

stance represent separate entities. It is probable that the enophthalmos will increase with the passage of time.

SYMPTOMATOLOGY

According to Wurdemann, in his excellent summary of the condition, the patient usually related that sometime following a contusion of the orbital region, a gradual recession of the involved eye occurred. In 14 cases reported by Hartung the enophthalmos appeared within a week after the injury in 3, while in the 11 remaining it developed after months and even years. In a few cases subjective symptoms of a foreign body in the eye, more often of anesthesia of the nose, cheek, and lips on the injured side, caused by damage of the intra-orbital nerve and infraction of the orbital floor have been described. Denig reported a case in which paresthesia occurred in the region of the trigeminus and on the injured side of the face.

Not uncommonly a scar is conspicuous in these patients. Almost invariably this involves the eyebrow, and sometimes it is painful to pressure. Not infrequently the upper lid droops and is less convex on the affected side, the palpebral fissure is narrowed, and the retrotarsal depression is deeper. When examined, the eyeball ordinarily is of normal size although the space between the orbit and the bulb is enlarged. Praun has compared the appearance of the eye in these cases with that observed in people with artificial eyes. There is as a rule full movement of the globe except in cases in which paralysis or fracture of the skull has occurred; binocular vision remains intact. Examination of the intra-ocular tension and fundus usually reveals nothing abnormal.

PROGNOSIS AND PATHOLOGY

According to Wurdemann further recession of the eyeball occurs in many cases. In the majority the visual acuity remains unchanged, but in a few instances vision becomes impaired even to the point of blindness.

Although theories advanced to explain the pathological process causing enophthalmus traumaticus have invariably sought to account for the phenomenon by an actual or relative increase in the orbital capacity, the methods given for the production of this effect by advocates of the various theories have been vastly different.

Praun divided cases of traumatic enophthalmos into the trophoneurotic, the cicatricial, and the mechanical forms. He felt that the first type occurred following blows from large objects upon the margins of the orbit or the skull, which caused a sinking of the bulb into the orbit. It was his opinion that a similar condition resulted from the trophoneurotic absorption of the retrobulbar fat as a result of

lesions of the nerve trunks or centers. He accounted for the cicatricial enophthalmos by periostitis of the orbit, which led to a contraction of the connective tissue and the orbital fat. He was of the opinion, moreover, that as a result of these inflammatory processes in the orbit and the cicatricial contraction, Tenon's capsule and the globe became more or less atrophic. Mechanical enophthalmos, on the other hand, he believed due to a fracture of the orbital walls which generally produced a downward and backward depression of these structures, thus allowing the eyeball to recede.

Lederer believed fractures of the orbital walls occurred in all cases of traumatic enophthalmos, and that with these fractures, hemorrhages into the orbital tissues resulted producing first of all an exophthalmos. The subsequent tearing of the tissues by the hemorrhage caused cicatricial contraction which secondarily produced enophthalmos. Lang was similarly convinced that a fracture or depression of the orbital walls always occurred, and felt that inasmuch as the pad of fat was only of sufficient size to fill the retrobulbar part of the normal orbit, it sank into the depression, causing a vacuum and forcing the eye back by atmospheric pressure. It was also Gessner's opinion that a mild periostitis and inflammation of the retrobulbar fatty tissue followed the injury and that with the resulting cicatricial contraction of the orbital contents, the eye sank backward. In an exhaustive article and study of 78 cases from the literature in addition to one of his own, Lukens was of the opinion that when there was no grossly depressed fracture the most rational explanation was that of absorption of orbital fat due to pressure incident to the violent cellulitis confined within the elastic bony cavity. Following subsidence of the intra-orbital swelling, the loss of fatty cushion became manifest and the eye receded.

Certain very plausible objections to these ideas have been advanced. As has been mentioned by Shoemaker, cicatricial contraction cannot be readily adopted for the reason that the enophthalmos has frequently occurred too soon after the injury. The globe, moreover, is usually freely movable. Not only this, but for the theory to be acceptable, enophthalmos should follow orbital cellulitis, whereas such is not the case. In regard to the theories of Lederer, Lang, and others that fracture of the orbital walls is the most probable cause of traumatic enophthalmos, it must be remembered that severe traumatism with undoubted and extensive fracture causing displacement of the eyeball should be considered as such and not as enophthalmos.

When less severe fractures are accepted as the usual explanation of the condition, the fracture, as Shoemaker has suggested, would have to be depressed, for a simple linear fracture would after union, theoretically at least, cause a diminution in the size of the orbit, because a certain amount of thickened periosteum and callus would be expected. Notwithstanding the thinness of the orbital walls fractures in this locality usually caused by indirect force are more apt to be linear than depressed. However this might be, it must be admitted for this theory as well as for other similar ones, that whereas in the condition contemplated, enophthalmos can and probably does exist, Tenon's capsule must in such cases be the victim of the serious interference; and it is damage to Tenon's capsule that seems to furnish the most logical explanation of the pathology of the enophthalmos.

As early as 1881 Talko, in summarizing 8 conditions in which enophthalmos had been noticed, referred in one of these to the smooth muscle fibers discovered by Sappey in and about the orbit, paralysis or spasm of which he reasoned would cause enophthalmos or exophthalmos, respectively. It was also Fick's opinion, in 1896, that the most probable cause was a laceration or rupture of the connective tissue fibers passing from Tenon's capsule to different points of the orbit and acting as suspensory ligaments of the eyeball. Mention was made also of the orbital fascia by Treacher Collins in 1899. He called attention to the opposition offered by this fascia to the muscle cone within the orbit. At the same time he referred to an interesting congenital case in which autopsy revealed much shortened muscles which were attached too far posteriorly, suggesting the possibility of an absence or misplacement of the check ligaments.

Other than these opinions, Tenon's capsule and check ligaments received little attention as probable elements in the production of traumatic enophthalmos until the comprehensive article of Shoemaker in 1900. As pointed out by him, the anatomical relations of Tenon's capsule with its check ligaments are such that they would seem necessarily involved to a greater or less extent in every case of this condition.

As described so well by Maddox, in 1898, the capsule of Tenon is a fibro-elastic membrane or fascia firmly attached anteriorly to the periosteum surrounding the orbital margin and to the periosteum circumscribing the optic foramen posteriorly, thus forming primarily a cone from which issue numerous subsidiary investing membranes covering in part every structure within the orbit. The check ligaments, which, close to their origin at the marginal insertion of the capsule contain smooth muscle fibers, are thickened bands of fibro-elastic material, which are attached posteriorly to the outer layer of the muscle sheath, to the belly of the muscle itself, and to that portion of the fascia investing the posterior hemisphere of the eyeball. All of the ocular muscles seem to be accompanied by check ligaments or their analogues. The involuntary muscle fibers in the check ligaments are, of course, innervated by sympathetic nerves.

The forces which influence the condition of equilibrium of the eyeball may be divided into those acting from a position anterior and posterior to its center of rotation, the former constituting what is known as the muscle cone, or the 4 recti with perhaps the levator, the latter being the 2 oblique muscles and the capsule of Tenon. When considered alone as 2 opposing muscular forces, the recti would have the balance of power and displacement of the eyeball would most likely accompany most contractions of these muscles. Although the orbital fat would lend important support as a cushion or buffer, it is not able to act as a fulcrum around which to change the direction of the applied force. The division of Tenon's capsule, which passes around the posterior portion of the globe and holds the eyeball somewhat in a sling, receives direct attachment from the check ligaments and is of considerable importance, for here resistance to backward pressure is ultimately transferred and traced through the check ligaments to a fixed insertion at the orbital margin. Shoemaker believed that all the forces exerted in ocular movements must terminate in the bones of the orbit, for these movements would be very uncertain and inaccurate if the basis of support itself were unsteady.

It therefore becomes reasonably apparent that Tenon's capsule and the check ligaments must always play an important part, and in some cases the all important part in enophthalmos. Relaxation of the capsule from any cause would permit recession of the eyeball; and a sufficient rupture of the capsule either near the orbital margin or in that division passing behind the globe, or rupture of the check ligaments, if extensive, would almost of necessity be followed by enophthalmos.

That recession does not always follow the injury immediately has been accounted for by the probability that a rupture often is accompanied by hemorrhage which would materially increase the orbital content behind the globe, thus counteracting the loss of anterior support until absorption has taken place. Indeed, as has been suggested, proptosis might be anticipated as the immediate result of the injury which ultimately leads to enophthalmos.

In considering Beer's theory which contemplated a lesion of the nerve centers or tracts, particularly of the trigeminal sympathetic, which he believed resulted in absorption and atrophy of the cellular tissues within the orbit, Shoemaker pointed out that granting such lesions were producible by the traumatism reported, it would seem reasonable to believe they would cause similar changes also in Tenon's capsule, thus robbing it of its power to support the eyeball properly in its normal position. Such seemed particularly applicable inasmuch as the check ligaments contain smooth muscle fibers also under the influence of sympathetic innervation. In this connection it seemed that exophthalmos might be produced in the reverse way by sympathetic irritation causing these muscular fibers to contract.

Zimmerman, finding a persistent reaction with cocaine in his cases, was of the opinion that traumatic enophthalmos without orbital fracture, based on the assumption of sympathetic paralysis, was a rather dubious supposition.

Whether there be one or several pathological explanations for enophthalmus traumaticus, the result of trauma to Tenon's capsule and the check ligaments as advocated by Shoemaker and others seems the most logical and the one best suited to explain the condition under varying circumstances.

DIFFERENTIAL DIAGNOSIS

According to Wurdemann, the differential diagnosis has to be made occasionally between progressive facial hemiatrophy, phthisis bulbi, and microphthalmos. Of these, the first, originally described by Romberg in 1846 and likewise known as Romberg's disease, seems the only one apt to be particularly confusing.

In an excellent review of this condition by Archambault and Fromm, in 1932, they were able to gather 400 cases from the literature. Of this group there were about 24 instances of total hemiatrophy and 27 of double facial hemiatrophy. Interestingly enough, a history of traumatism preceding the onset of the condition was found in 25 to 35 per cent of the cases. Moreover, quite similar to traumatic enophthalmos, in the great majority of cases the interval was from 2 to 3 weeks to a few months, though in some cases years elapsed between the injury and the onset of the atrophy. They believed it constituted more than a localizing or concurrent factor and that it might be the primary etiological factor, though they were cognizant that the actual etiology still remained largely speculative.

In progressive facial hemiatrophy the atrophic process as a rule involves all of the tissues, affecting the subcutaneous fat and connective tissues most severely, sometimes sparing the skin, and much more rarely the bony structures. The facial hemiatrophy may begin at any point, such as the region of the orbit, about the angle of the mouth, or the wing of the nose, over the malar prominence, or along either the vertical or horizontal segment of the mandible. From its point of origin the atrophic process may spread either gradually or rapidly until the entire half of the face is involved, or it may come to a standstill spontaneously at any stage of its evolution. Although known as facial hemiatrophy, this peculiar dystrophy has in many cases extended to the neck, the upper part of the thorax and arm, and even the entire half of the body. Although the condition occurs ordinarily in early life and especially during the second decade, it may develop at any age, even in advanced life.

CORRECTNESS OF DIAGNOSIS

Although there are features of the first case not unlike progressive facial hemiatrophy, the diagnosis of traumatic enophthalmos seems more logical. When in facial hemiatrophy the atrophy is not confined to the orbit but more extensively involves one side of the face, the differential diagnosis is a simple matter.

In a fair percentage of cases, that is 25 to 35 per cent, progressive facial hemiatrophy follows an injury about the cranium, face, or neck, the atrophy occurring after a length of time quite similar to that of traumatic enophthalmos. In progressive facial hemiatrophy, however, the atrophic process usually involves all of the tissues including the bony structures, something not evident in the presented case. Though the facial hemiatrophy may begin at any point, such as the orbital region, the atrophic process usually spreads either gradually or rapidly until the entire half of the face is involved. On the other hand, it may come to a standstill spontaneously at any stage of its evolution.

In traumatic enophthalmos further recession of the eyeball occurs in many cases with loss of vision, while in others the visual acuity remains. In the present case, the beginning of symptoms of blurred vision may be an early indication of visual impairment.

Among other things difficult to explain in traumatic enophthalmos is the fact that in the presence of so many head injuries, serious and otherwise, the condition is so uncommonly observed. Moreover, if trauma is accepted as the primary etiological factor in progressive facial hemiatrophy, the same difficulty occurs. In addition to trauma, there must evidently

be some individual peculiarity which is responsible for the infrequent occurrence of these two interesting conditions.

If, in the first case, the atrophy and orbital recession, which has been evident for 13 years should spread to involve other portions of the face, the diagnosis of progressive facial hemiatrophy would, of course, have to be conceded. At the present time, however, the diagnosis of traumatic enophthalmos seems correctly designated.

SUMMARY AND CONCLUSIONS

1. Three cases of traumatic enophthalmos are reported together with a discussion of their symptoms, objective findings, and prognosis. The condition is compared with that of progressive facial hemiatrophy.

2. It was found that in 1930 Birch-Herschfeld had collected 164 cases of this relatively uncommon condition.

3. All theories advanced to explain the pathological process causing traumatic enophthalmos have invariably sought to account for it by an actual or relative increase in the orbital capacity, but the methods given for the production of this effect by advocates of the various theories have differed considerably.

4. Shoemaker's conception of the usual cause of the enophthalmos being due to a rupture of Tenon's capsule or its thickened bands known as the check ligaments is felt to be the most logical explanation under varying circumstances. This theory and the others most usually advanced are discussed.

5. It is believed that many cases of relatively slight traumatic enophthalmos, especially in their earlier stages, escape observation.

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BLOOD SUPPLY OF THE MAMMARY GLAND

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Surgical Considerations by John A. Wolfer, M.D.

IN a recent anatomical study of a female cadaver the blood vessels which supply the mammary gland were remarkably well shown.[1] Since satisfactory illustrations of the arteries in this region are rare, the authors venture to present a brief record of this phase of their investigation. The dissections were carried out in serial order, and drawings of the successive levels were prepared at natural size. The veins, which accompany the arteries, need not be described.

Right Side

INTERNAL MAMMARY ARTERIES

The internal mammary artery, arising from the first portion of the subclavian within the neck, descends into the thorax under cover of the clavicle and the first rib; passing downward behind the cartilages of the succeeding ribs to the level of the sixth intercostal space, it divides into superior epigastric and musculophrenic branches (Fig. 6).[2] Of the various branches given off in its thoracic course those which concern the present study are the anterior perforating arteries.

1. *Anterior perforating arteries.* Five perforating arteries are present, one corresponding to each of the five upper intercostal spaces. Arising in serial fashion from the front of the internal mammary, and passing through the intercostal muscles they reach the pectoralis major, which they supply through muscular rami; the terminal twigs of the latter penetrate the muscle close to the sternum, and are distributed to the integument as cutaneous rami (Fig. 1). The second, third, and fourth perforating vessels are usually described as supplying the medial and deep surfaces of the mammary gland. In our specimen, on the right side, only the first and fourth perforating arteries give laterally directed branches to the breast (see arrows, Fig. 6); the others have no mammary rami.

As is shown in superficial dissection of the mammary tissue, the mammary rami of the anterior perforating branches constitute the chief supply of the breast (Fig. 1). The first perforating branch courses lateralward to the superior margin of the breast, there dividing into parallel rami (Fig. 1, *a* and *b*) and supplying, by numerous offshoots, the cephalic fourth of the right breast; the main channels join again at the axillary margin, anastomose with the mammary ramus of the lateral thoracic artery (Figs. 4 and 5). Proximal to the division into mammary rami, the first perforating artery gives off two twigs, one directed upward, the other downward. The fourth perforating branch is a strong stem, branches of which pass cranial to the nipple, (Fig. 1, *b* and *c*); they are terminal, and do not anastomose with axillary stems. Proximal to the division, branches of medium caliber are given off, two upon the breast (Fig. 1, *a* and *d*) and one along the inferomedial margin (Fig. 1, *e*).

In addition to these, near the sternum a branch is sent downward to anastomose with the perforating artery next below. Of the other perforating branches only the fifth affects the mammary area, and indirectly by anastomosing thinly with the fourth. The mammary rami course in the most superficial portion of the fatty pannicle, giving off finer

[1] The specimen is a nulliparous negro woman, 20 years of age, 5 feet 3 inches in height, weighing 72 pounds (embalmed). The specimen was employed in a recent study of the endopelvic fascia of the female pelvis (Curtis, A. H., Anson, B. J., and McVay, C. B., Surg., Gynec. & Obst., 1939, 68: 161–166).

[2] The musculophrenic artery leaves the internal mammary at the sixth intercostal space, finally reaches the eighth; it sends an anterior intercostal to the seventh and eighth spaces and a phrenic branch to the diaphragm, but provides none of the mammary supply.

Contribution No. 283 from the Anatomical Laboratory of Northwestern University Medical School.

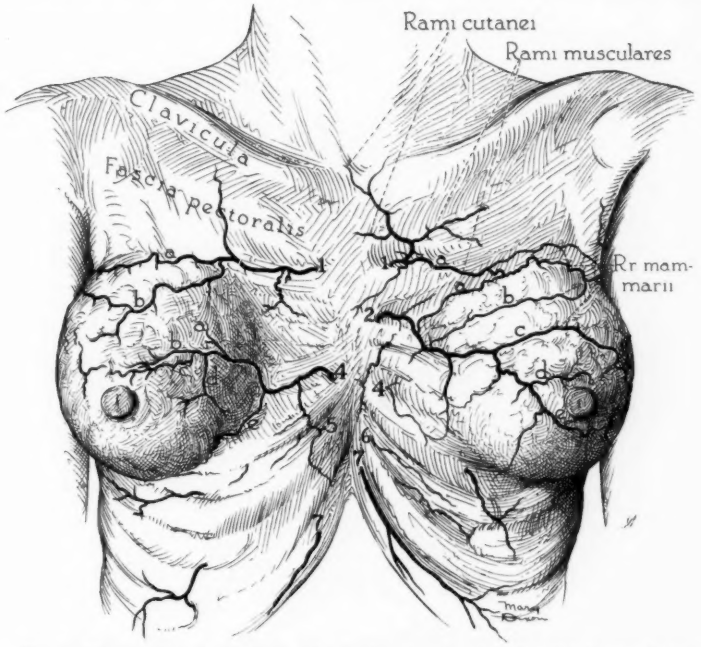

Fig. 1. Mammary rami of the anterior perforating arteries. One-third natural size. Except in the mammary region, the superficial fascia has been removed to show the course of the arteries. The numbers indicate the intercostal rami of the perforating arteries.

twigs which penetrate the breast to varying depths.[1]

2. *Anterior intercostal arteries.* Two anterior intercostal arteries, in each of the 6 upper intercostal spaces pass laterally from the internal mammary artery; one courses along the lower border of the rib above, the other along the upper border of the rib below (Fig. 6). The arteries lie at first between the internal intercostal muscles and the pleura, afterward between the external and the internal intercostal muscles. They supply the intercostal muscles, the pectoralis major, and as well send nutrient vessels to the ribs.[2] No rami arising from the intercostal arteries reach the mammary tissue.

[1] Ramus *a* (Fig. 1) of the first perforating artery gives only small superficial branches to the breast. Ramus *b* sends several vessels of fair size into the breast, penetrating the tissue to depths of from 0.3 centimeter to 1.2 centimeters. Rami *b* and *c* (Fig. 1) of the fourth perforating artery, supplying the area around the nipple, send strong branches into the mammary tissue to depths of from 1 millimeter to 2.0 centimeters. However, no vessels of dissectable size reach the level of the pectoralis major muscle; therefore, no demonstrable anastomoses are formed with any twigs derived from the so called medial mammary branches of the anterior intercostal arteries.

[2] In the fifth intercostal space the branches arise separately from the internal mammary; in the spaces superior thereto they arise by a common trunk; the spaces below the fifth are supplied through the musculophrenic.

AXILLARY ARTERY

Continued into the upper limb, the subclavian (Fig. 6) becomes the axillary artery (Fig. 5). Within the axillary fossa branches are supplied to pectoral structures. Two of these arteries of the axillary group send branches to the breast (Fig. 4). The first is the lateral thoracic artery, from which a medial branch is derived; descending along the outer margin of the breast, it sends small twigs into the gland, larger branches to the thoracic wall. The second is a muscular trunk which parallels the course of the axillary artery; from it a lateral mammary ramus is given off, which, crossing the superior fourth of the gland, divides into two portions; these anastomose with the mammary rami of the first perforating artery (Figs. 1 and 4, at *a* and *b*).

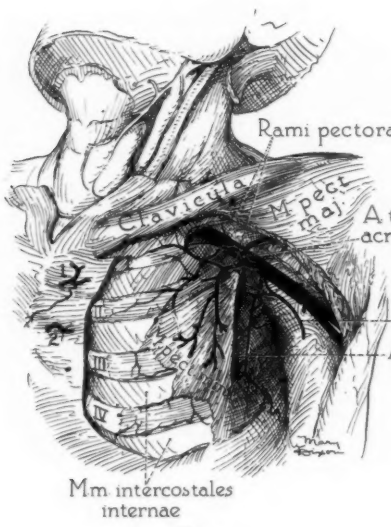

Fig. 2.

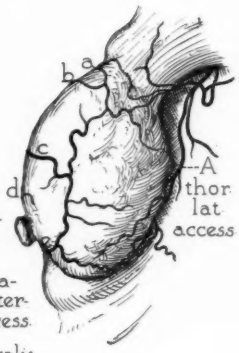

Fig. 3.

Figs. 2 to 5. Figures 3 and 4 show mammary branches of the axillary artery; Figures 2 and 5, chiefly muscular branches of the axillary artery. Figures 2 and 3 are of the left side, Figures 4 and 5 of the right. Figures 3 and 4 are lateral views, Figures 2 and 5 are anterior. One-third natural size. In Figures 3 and 4 the glandular tissue is intact; in Figures 2 and 5, the mammary gland has been completely removed, the subjacent pectoral muscles either cut away or turned aside to expose the deep (muscular) branches of the axillary artery.

No other branches of the axillary supply any portion of the mammary gland; pectoral rami from the thoraco-acromial pierce the pectoralis major muscle on its deep aspect, but do not reach its superficial aspect.

Left Side

Internal Mammary Artery

On the left side the branches of the internal mammary artery which supply the general region of the breast are arranged in a manner fundamentally similar to that which obtains on the opposite side of the body (Fig. 6).

1. *Anterior perforating arteries.* Only two perforating arteries supply the breast.[1] The first perforating branch sends a laterally directed stem along the cephalic margin of the breast (Fig. 1, ramus *a*); from this stem minute twigs pierce the glandular mass directly, others are sent downward to anastomose with the upper branch of the vessel from the artery arising in the second intercostal space; continuing laterally as a fine stem, the mammary ramus anastomoses with the accessory lateral thoracic artery (Fig. 3). Proximal to the point where the mammary rami are given off, the perforating artery sends branches toward the sternum and the clavicle; these are cutaneous and muscular rami (Fig. 1). The second perforating branch sends virtually all of its rami to the gland. The main stem passes obliquely downward, below the nipple, then, ascending on the lateral aspect of the breast, communicates with a second division of the accessory lateral thoracic artery (Fig. 3). Enroute to the axilla, the second perforating gives off four transverse branches, the stem itself continuing as the fifth (Fig. 1, *a* to *e*). These course as follows: the first (Fig. 1, *a*)

[1]Anterior perforating arteries were found to be few in number in four additional female bodies, examined in the anatomical laboratory; the results of the dissections may be summarized as follows: Specimen A, second intercostal space on the right side, first and third spaces on the left; Specimen B, second and third on the right, second and third on the left; Specimen C, first and third on the right, first and third on the left; Specimen D, second and fourth on the right, second and third on the left.

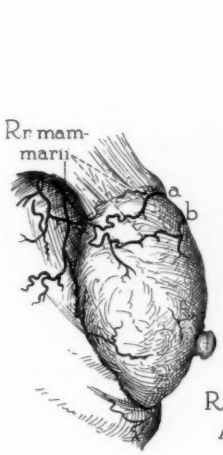

Fig. 4.

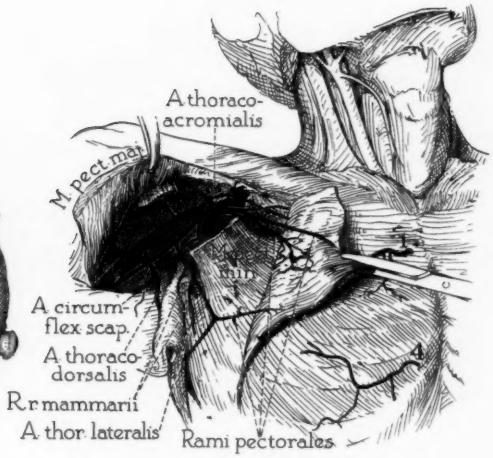

Fig. 5.

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crosses the upper margin of the breast, anastomosing with the vessel superior to it, finally connecting with the axillary stem—but after having joined the vessel next below (Fig. 1, *b*); the third transverse stem (Fig. 1, *c*) is a relatively large vessel which crosses the middle of the breast, anastomoses with a downward-directed branch from the axillary and with an upward-directed one from the fifth (Fig. 1, *e*) of the transverse set, encircling the nipple in so doing; the fourth (Fig. 1, *d*), passes immediately above the nipple, is lost in glandular twigs; the fifth (Fig. 1, *e*) courses below the nipple, divides into two branches; each of these branches has an anastomotic connection (Fig. 3), the medial branch with the third in the set of mammary rami, the lateral with an accessory lateral thoracic artery (the lateral connection occurring at the outer margin of the gland). Of the remaining perforating branches (the third through the seventh) only the fourth contributes to the mammary scheme of the arteries, and this one does so only by sending a minute anastomotic twig to the second perforating artery (Fig. 1).[1]

[1]The mammary rami on the left side, as do those of right, penetrate the breast to varying extents. Rami *a*, *b* and *c* of the second perforating artery send small branches inward to depths of 1 to 2 millimeters; rami *d* and *e*, supplying the area around the nipple, are lost in the tissue of the gland at a depth of 2 centimeters. The fourth perforating artery supplies chiefly the fascia and periosteum of its own immediate area.

2. *Anterior intercostal arteries.* The anterior intercostals of the left side, in the first and fifth spaces, arise separately; in the second to fourth spaces, as branches of a trunk (Fig. 6). In the sixth the musculophrenic supplies the anterior intercostal branches, continues as a phrenic branch. No rami of anterior intercostal origin reach the mammary tissue.

AXILLARY ARTERY

On the left side, as on the right, two mammary stems arise within the axillary fossa (Fig. 3); both are branches of an accessory lateral thoracic artery (Fig. 2); the arteries and the accompanying veins form a "pedicle" as they leave the axillary space. The medial branch descends obliquely in the sulcus at the outer margin of the breast, anastomoses with the lowermost ramus from the second perforating artery (Fig. 3). The lateral branch crosses to the upper part of the breast almost transversely, then sends a branch upward, one downward; the former anastomoses with two rami (Fig. 2, *a* and *b*), the latter with one ramus (Fig. 3, *c*).

The lateral thoracic artery proper supplies the serratus anterior and intercostal muscles; terminally, the main stem breaks up into twigs which extend as far as the fifth inter-

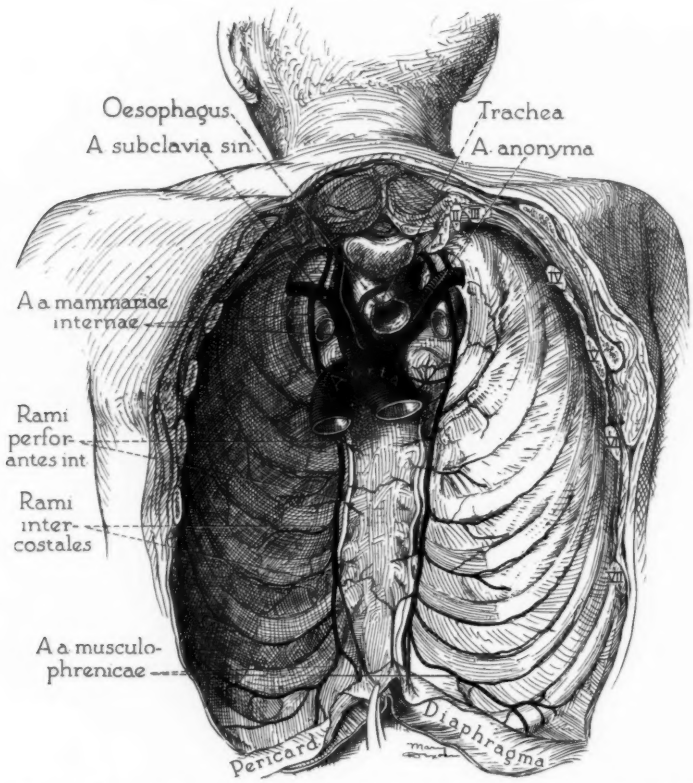

Fig. 6. The internal mammary arteries and their branches, on the inner aspect of the anterior thoracic wall. One-third natural size. The thoracic viscera and their serous investments have been removed to expose the vessels; the internal intercostal and transverse thoracic muscles have also been removed. The points at which the main perforating arteries pass through the intercostal structures are indicated by arrows (Fig. 1).

costal space (Fig. 2). The lateral thoracic sends no branches to the mammary gland.[1]

SUMMARY

1. The mammary gland receives its blood-supply from two chief sources, namely, the anterior perforating branches of the internal mammary artery, and the mammary rami of the axillary artery itself or one of its main stems.

2. The mammary rami of the anterior perforating arteries form a transversely arranged series, extending from the first to the fourth intercostal spaces.

3. The mammary branches of the axillary artery leave the axillary fossa together; accompanied by the corresponding veins they form a small "pedicle" of vessels.

4. Upon the breast the mammary vessels occupy the most superficial level of the fatty tissue, being virtually subcutaneous in position.

[1] The thoraco-acromial gives rise to a pectoral ramus which is short but thick. It passes at first along the superior border of the pectoralis minor, having attained the muscle's external surface by arching over the superior margin (Fig. 2). After giving off two twigs (one of which is a clavicular) it divides into two stems; the upper courses over the second rib, while the lower passes inferomedially to the fourth rib; these give off twigs to the pectoralis major and minor between which the vessels are situated. Subscapular, circumflex scapular, dorsal thoracic, anterior humeral circumflex and posterior humeral circumflex arteries arise from the axillary, but do not affect the mammary area.

5. From these various mammary rami smaller twigs are given off, at a right angle, into the substance of the gland; the more prominent of these are traceable into the mammary tissue to a depth of approximately 2.5 centimeters.

6. Both upon the surface of the gland, and within its substance, anastomotic communications between neighboring rami are common.

7. None of the so called medial mammary branches of the anterior intercostal arteries pierce the pectoral musculature to reach the overlying mammary gland; they terminate as muscular branches, leaving the deep or thoracic aspect of the gland devoid of arteries of gross proportions.

8. Similarly, none of the pectoral rami of axillary derivation pass from the deep level through anterior appendicular muscles to supply the mammary gland.

9. No vessels reach the gland from the inferior aspect; they approach the gland only from the medial and the superolateral aspects.

SURGICAL CONSIDERATIONS

The female breast is considered by most surgeons to be a highly vascular organ, yet all too frequently little consideration is given to the source of its blood supply; operations are planned from the viewpoint of a ready approach to the lesion, of cosmetic results, and not in relation to the vascular elements of thoracic anatomy.

In performing a radical mastectomy, since all the breast as well as the underlying muscles are removed, the operator need give but little consideration to the blood supply of the breast except in so far as complete hemostasis is concerned.

The common approach for removal of benign mammary tumors and cysts, especially those which occupy the inferior half of the breast, is through a curved incision made at the junction of the inferior margin of the breast and the thoracic wall. This approach places the resulting scar out of sight, and therefore has distinct cosmetic value. Furthermore, since the major arteries enter the gland on the superomedial and superolateral aspects, the low incision is least likely to produce troublesome bleeding; in fact the entire mass of mammary tissue may be raised from the underlying pectoral fascia without appreciably disturbing its blood supply. In removing the tumor or cyst, the operator should first follow the line of cleavage between the breast and the pectoral fascia, and then enter the breast itself directly beneath the tumor. If this procedure is followed not only will there be less bleeding, but there will also be minimal trauma to breast tissue. The skin incision may be widened by carrying it laterally and medially if necessary, even, to the transverse line of the nipple. However, in most instances such extension is not required; when carried out it may bring part of the scar into view.

In the removal of tumors from the superior half of the breast, especially when the nature of the tumor is in doubt, the incision should be made radially to the nipple. This again prevents to a marked degree severance of major blood vessels which supply the breast and results in less deformity.

The concentration of blood supply in the superior half of the breast explains the occurrence of severe hemorrhage from ulcerative lesions in that region. Likewise, when incision is made into a deep seated abscess in the superior portion, a large vessel may be severed and severe hemorrhage may occur.

Plastic procedures which are designed to elevate a large pendulous breast can be carried out with comparative safety so far as the blood supply is concerned, since there exists inferiorly an area in which vessels are few in number. For this reason, also, excision of breast tissue should be made from the inferior, not from the superior portion.

ACUTE DIVERTICULITIS OF THE COLON

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DIVERTICULOSIS is the most common condition of the colon that comes to the attention of the surgeon. In routine examinations from 0.4 per cent to 1 per cent of all patients in whom x-ray examinations of the large intestine are made after a barium enema, this condition will be found. In patients over 40 years of age who present themselves for examination because of some abdominal discomfort, diverticulosis will be discovered in from 5 to 10 per cent. In the great majority of these patients the presence of diverticula cause no symptoms and the condition is discovered in a routine examination of the colon.

According to Sommering diverticula of the colon were described in Baillie's *Morbid Anatomy* in 1794. Virchow reported "chronic adhesive peritonitis" in 1854, and in 1899 Graser associated this observation of Virchow's with diverticulitis. Beer wrote a good description of the condition in 1904, and in 1907 W. J. Mayo, Wilson, and Giffin reported 5 cases of diverticulitis treated in the living. Roentgenologists first recognized the condition in 1914. From this time until the present, diverticulosis and diverticulitis of the colon have been given increasing attention in medical literature.

The cause of diverticulosis has been much discussed and there are differences of opinion as to what area in the circumference of the bowel is most affected. In the large gut there is a wide variation in the relation of mesentery to bowel. Depending chiefly upon the length of mesentery there is a narrow or wide ribbon of the gut uncovered by peritoneum. Leakage through this area causes extraperitoneal infection.

The longitudinal muscular coat has a peculiar arrangement in the colon. This outer muscular coat is piled up in three longitudinal bands or teniæ. Between these bands the circular muscular coat is thrown into folds or sacculations. These sacculations grow larger and deeper with age. David says "these sacculations are separated by fusiform ridges composed of all layers of the intestine as much mucosal as muscular" and "that these sacculations and ridges retard the passage of fæces."

Close to the mesentery the vessels penetrate a portion of the thickness of the gut and it is believed by some observers that diverticula occur at these points. Klebs was the first to stress this opinion. Much experimental work has been done on the living gut of animals and on the dead human colon to determine the areas of greatest weakness. Experimental data have been presented in support of the belief that the mesenteric border will give way first when the gut is under pressure, but surgeons have observed over and over again that in dealing with the distended colon it is the peritoneal coat that gives way first and moreover postperitoneal phlegmon due to perforation of the gut between the layers of the peritoneum is a very rare finding in the postmortem examinations of patients dead of intestinal perforation, except in penetrating wounds of the abdomen.

Diverticula are divided into two classes, congenital and acquired, and many writers speak of them as true and false. In the congenital or true type the wall of the diverticulum contains all of the coats of the intestine. This type plays a relatively unimportant part in diverticulosis and diverticulitis of the large intestine.

In acquired or false diverticula there is a thinning out or absence of the circular muscular coat causing herniation of the submucosa and mucosa through the circular muscle. Most observers agree that acquired diverticula of the colon are found chiefly between the longi-

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tudinal bands and not through the region of the mesentery. It would seem, therefore, that atrophy and stretching of the circular muscular coat brought about by fatty degeneration, age, and thinning of the gut wall are the chief etiological factors in acquired diverticula. Constipation and increased pressure within the gut from gaseous distention are associated causes.

All of these changes are associated with advancing years and David has called attention to a frequent finding in the aged of small diverticula between the teniæ and the presence in the sacculations of the colon of small masses of fecal material.

While most patients with diverticulitis are over 40, this condition may occur in the young. Hartwell and Cecil report 2 cases, 7 and 10 years of age respectively, and Ashhurst 1 patient, 7 years of age. One of our patients with an acute diverticulitis of the cecum was 19. Grove and Bell reported in September, 1938, a case of sigmoid diverticulum, which was apparently congenital, in a white female child 4½ years old, in which diverticulitis developed with abscess formation. It was drained and was followed by a fecal fistula for several weeks. This diagnosis was confirmed by x-ray and later operation.

In acquired diverticulosis the herniation of the gut wall may take place into the appendices epiploicæ. In most instances the neck of the sac is small; the peritoneal coat is partially covered by tags of fat and unless a careful search is made for diverticula they are apt to be overlooked at operation, unless they are filled with fecal material or inflamed.

There are conflicting reports as to the influence of sex on the incidence of this condition. It is generally agreed that both diverticulosis and diverticulitis are more frequent in males, but the relative frequency in the different reports varies between 4 to 1 and 1.25 to 1. While the evidence is conclusive that diverticulosis is more frequent in males, diverticulitis in women is almost as common as in men.

Diverticulitis is less common in the negro. In 7,000 autopsies reported from Cook County Hospital by Kocour he found 127 cases of diverticulosis, an incidence of 1.81 per cent. In 6 of these 127 cases death was due to diverticulitis. He found the condition less frequent in colored people. In our own experience of 24 operative cases presently to be discussed only 1 was a negro.

The rôle that fat plays in both diverticulosis and diverticulitis is variously estimated. Formerly there was a widespread belief that these conditions are much more frequent in fat, flabby persons, who have eaten too much and exercised too little. This opinion is strongly held by most British writers. The majority of our cases of diverticulitis coming to operation have been in fat people. Careful study of large numbers of patients is modifying this opinion. Brown and Marcley in an analysis of 527 patients with diverticula of the colon in whom the weight was noted found 297 were overweight; 180 of normal weight and 50 were thin. They state "a plump patient is more likely to have diverticula of the colon than is a thin patient, but leanness does not make patients immune to this condition."

Diverticula are seen throughout the colon. In all reports the incidence of the condition increases from cecum to sigmoid. Individual writers have found more than half of these lesions in the sigmoid. In Judd and Pollock's series of 118 cases the sigmoid was affected in 75 per cent and Masson reported this portion of the large intestine affected in 81 per cent. We have found a relatively higher incidence in the cecum. Of 24 patients coming to operation in 6 the diverticula were in the cecum; in 1 at the hepatic flexure, in 3 in the transverse colon, and in 1 near the splenic flexure. In 11 instances the diverticula were in the ascending and transverse colon and in 13 in the sigmoid. It is interesting to note that although multiple diverticula are reported in a large percentage of patients with diverticulosis, there is little clinical evidence of diverticulitis attacking different sections of the colon in the same patient.

There is considerable anxiety as to the relationship between diverticulitis and carcinoma. It is very often difficult to differentiate between the two by symptoms, examination, or even at the operating table, but the question that is very important is whether or not diverticulitis predisposes to cancer. Apparently not. Rankin reports 4 carcinomas of the

colon in 227 patients with diverticulitis. In Kocour's 127 cases of diverticulosis in 7,000 autopsies there was 1 carcinoma.

On the other hand a chronic, adherent diverticulitis may seriously complicate excision of the colon for carcinoma. David and Gilchrist in May of 1938 reported acute diverticulitis complicating inoperable carcinoma of the sigmoid in 2 patients in whom death was due to perforation of an inflamed diverticulum proximal to the carcinoma. I have a patient in hospital at this writing, a thin man, 62 years old, whose condition before operation was diagnosed as acute diverticulitis of the transverse colon. When the mass was exposed it was found to be a perforated carcinoma in which the infection had been localized by omentum, gut wall, and mesentery.

Most diverticula of the large gut are acquired herniations of the mucosa and submucosa through the circular muscular fibers, either between the longitudinal bands or between the lateral teniæ and the mesentery. They may occur through the mesenteric border, but not very often. If such a diverticulum perforates, a postperitoneal phlegmon may develop and infection and suppuration may burrow outside of the peritoneum and point just above the inguinal ligament or the crest of the ilium, or the iliopsoas muscle may be invaded and a psoas abscess develop. When diverticula develop on the free surface of the gut they may protrude into an epiploic appendage or be partially covered by fat tags. They are usually relatively small when compared to the size of the colon, the neck of the sac is often constricted, and they may or may not contain fecaliths. In most instances these lesions produce no symptoms and the condition is known as diverticulosis.

If one such diverticulum becomes infected by reason of irritation or deficient drainage into the gut, the area becomes inflamed. From this beginning the various phases of diverticulitis may develop. Because the neck of the sac is often constricted, it may be occluded by exudate or hardened feces.

It is interesting to speculate as to what percentage of individuals with diverticulosis will develop diverticulitis. The percentage has been given as between 12 and 20 per cent. In the light of more recent observation, an average figure between these two is probably too high. Diverticulitis may be acute, chronic, or recurrent. The difference between chronic and recurrent has more to do with symptoms than pathology. Whether the condition is acute or chronic, the treatment in the majority of cases should be expectant. Operative treatment is undertaken for the complications of diverticulitis, which are (1) perforation with abscess formation, (2) perforation with diffuse peritonitis, (3) obstruction, and (4) fistula. Operation is sometimes undertaken because of uncertainty as to diagnosis in the acute abdomen, especially when the lesion is in the cecum. It may not be possible to differentiate before operation between chronic, constricting infection of the bowel because of diverticulitis and carcinoma, and a number of patients with acute diverticulitis are operated on who would probably have gotten along satisfactorily without operation, because the diagnosis of diverticulitis could not be made with certainty before operation. More careful attention to history and examination will reduce the number in this latter group, but there will be occasions when operation seems the wiser procedure in the acute abdomen, even when diverticulitis is suspected.

Brown and Marcley analyzed 1,100 cases of diverticula of the colon in the Mayo Clinic in the decade from 1927 to 1937. They divided them into three groups.

Group 1, 99 cases of diverticulitis treated surgically, either before entering the clinic or at the clinic; 36 of these patients died either following operation or later.

Group 2, 277 cases of diverticulitis in which the treatment was medical; 118 of these patients recovered, 61 continued to have symptoms, and 59 were known to have died; however, death in many instances was not caused by diverticulitis.

In Group 3, there were more than 700 of these patients without symptoms of diverticulitis and 220 of these were followed. There was little evidence of trouble in any of this group and 139 of these 220 patients were known to have lived 6 or more years without symptoms of diverticulitis. These patients were treated medically, however.

There are a number of satisfactory classifications of diverticulitis. W. J. Mayo's classification as given by David may be modified somewhat as follows:

1. Self-limited diverticulitis. This is the group in which most cases are found and are treated medically in most clinics. They are usually chronic or recurrent and associated with discomfort due chiefly to spasm. They do not always get entirely well under treatment, but are much improved and if properly cared for are not apt to develop surgical complications.

2. Diverticulitis and peridiverticulitis, but without perforation. In one group the process may be acute or chronic and may develop as an adherent mass, often with thickening of the mesentery. The gut is more or less fixed by its adherence to surrounding structures and by shortening of the thickened mesentery. Another group manifests itself as an inflammatory mass, chiefly involving the gut wall, but without serious narrowing of the lumen of the bowel and with little fixation. If the process does not develop beyond this stage these patients are best treated medically, and the great majority will recover without operation.

3. Diverticulitis and peridiverticulitis with perforation. In this group the perforation may develop in a number of ways.

a. By localization of infection, because of adhesions and abscess formation. If the abscess is drained before obstruction develops, no other operative treatment may be required and many of these patients recover. Fecal fistula may follow drainage or intestinal obstruction occur later because of angulation of small intestine in the wall of the abscess.

b. By perforation into the peritoneal cavity with the development of diffuse peritonitis. There is rarely much actual escape of bowel content, so that feces are not often found in the peritoneal cavity, but the peritonitis is a spreading one and if treatment is not undertaken until the peritonitis is late the prognosis is very bad. In this connection it is well to keep in mind the possible presence in the peritoneal cavity of the anaerobes, especially the Clostridium welchii.

c. Perforation into the tissues outside of the peritoneal cavity with the possible development of postperitoneal phlegmon, psoas abscess or other extraperitoneal collections of pus.

d. The formation of a fistulous tract between the colon and some adherent structure. These complications may present some of the most troublesome of the surgical complications of diverticulitis, and may involve the urinary bladder, the ureter, small or large intestine, the appendix, uterus, tube, or ovarian cyst. External fistulas have already been mentioned.

4. Diverticulitis with obstruction. These patients usually present a double syndrome, infection, and obstruction. In most of these cases the symptoms develop relatively slowly and the resemblance to carcinoma is disturbing. Bleeding is not common in diverticulitis, but may be seen in this group. The late Daniel Jones was much concerned with the differential diagnosis in this group and advocated exploration of these patients, because he felt that it was often not possible to exclude cancer by history, examination, or x-ray.

5. Diverticulitis, a possible avenue of infection through which lymphatics or blood stream is invaded. David and Gilchrist in May, 1938, reported the histories of 2 patients, both physicians, both gravely ill on admission and with few symptoms and signs that pointed to diverticulitis. At autopsy each had thrombophlebitis of a branch of the portal vein running from an infected diverticulum, with multiple abscesses of the liver.

6. Diverticulitis of the cecum. This condition presents a somewhat different problem from diverticulitis in the rest of the colon. Because appendicitis is such a common disease and because patients with acute appendicitis without complications are operated upon promptly in most clinics, early diverticulitis of the cecum is occasionally found during the course of operation for what was supposed to be acute appendicitis. Here an early self-limited diverticulitis may be seen without peridiverticulitis or perforation. Such a condition might very well subside without operation, if the correct diagnosis had been made, but, considering all phases of the condition, the correct diagnosis will be made very rarely. Under these circumstances the proper procedure is to tie off the diverticulum, turn in the wall of the

cecum, over the ligature, if possible, and if this cannot be done, cover the site of the ligature with a pad of fat from the wall of the cecum or a graft from the omentum.

Because diverticulitis is most common in the sigmoid, acute diverticulitis often resembles left-sided appendicitis, and chronic diverticulitis must be differentiated from carcinoma. If attention is paid to the history and care, and thought is given to all methods of examination the symptoms may be evaluated with a fair degree of accuracy, but a large number of possibilities must be borne in mind, depending chiefly upon the location of the lesion in the colon and whether or not the diverticulitis is complicated by peridiverticulitis, adhesions, abscess, peritonitis, pylephlebitis, postperitoneal infection, obstruction, or fistulas.

Pain is the most common symptom. This may be intermittent in character and due largely to spasm which is a frequent phenomenon occurring in the colon in this disease. However the pain may be continuous and boring in character. There may be only a feeling of uneasiness in the lower abdomen. More than half of the patients with diverticulitis give a history of constipation and from 10 to 15 per cent have intermittent diarrhea. The stools may be narrowed by spasm or small, hard masses of feces may be seen. Blood in the stools is not common. Pus is rarely seen. Many of these patients give a history of unsatisfactory evacuations, however, and if the lesion is low some discomfort is often felt, referred vaguely to the sacral region. There is the same uncertainty as to the presence and significance of flatulence.

If the lower sigmoid is involved in women, there may be considerable confusion as to left-sided pelvic disease and in both sexes the proximity of the sigmoid to the bladder causes urinary symptoms in about one-fourth of the patients. If there is a fistula into the bladder, gas and fecal contamination will be evident in the urine. The fistula may be seen with the cystoscope. Nausea is fairly common, but vomiting is not an outstanding symptom. Even in the obstructive cases distention of the proximal colon may allow the upper intestinal tract to drain itself into the large intestine for a number of days without resort to vomiting.

Tenderness is a helpful symptom, when present, and tumefaction was reported by Rankin and Brown in 31 per cent of the 227 cases of diverticulitis reported by them in 1930. They also report that in the 48 patients in this series operated upon the hemoglobin was below 70 in about one-fourth of the cases.

If the patient's condition warrants a barium enema, roentgenoscopic examination is the most satisfactory and conclusive method of diagnosis. Care should be taken not to load up the bowel above the lesion with a barium meal.

Proctoscopic examination is helpful in some cases, diagnostic in a few, and negative very often. It is very helpful in differentiating between carcinoma and diverticulitis, if the lesion is within reach of the sigmoidoscope. In a few instances the openings of the diverticula may be seen. More often the sigmoidoscope will discover fixation of the sigmoid, and edema and reddening of the mucosa without ulceration in low sigmoid involvement. This finding is most helpful in differentiating between possible diverticulosis and carcinoma. It may give information as to the length of healthy mucous membrane below the lesion.

The treatment of diverticulitis is operative only when complications exist or the diagnosis cannot be made with reasonable certainty in the acute abdomen or the question of carcinoma cannot be otherwise settled in chronic colonic disease.

The need for operative procedures has already been given under classification. The surgeon has a considerable number of operative attacks at his disposal when he is dealing with acute or chronic diverticulitis requiring operative relief. Early diverticulitis of the cecum has been discussed under classification. The most common complication requiring surgery is peridiverticulitis with localized abscess. Here drainage of the abscess with a minimum handling of the intra-abdominal structures is indicated. If there are no obstructive symptoms simple drainage is all that is necessary. It is unwise to attempt to deal with the infected diverticulum. There is considerable recent literature dealing with the bacterial flora of the appendix and large intestine and the different micro-organisms found

in peritonitis. When perforation occurs the issue is determined largely by the kind, number, and virulence of the organisms and the resistance of the host.

"There are fairly uniform reports as to the aerobes, Escherichia coli (Bacillus coli) and various strains of streptococci being found in a high percentage of cases. Other aerobes are found as well; the staphylococcus, a gram-positive bacillus, and others. Occasionally Hemophilus influenzæ (Bacillus influenzæ) is present.

"Altemeier in 100 cases of perforated appendicitis recovered 16 different aerobes from the purulent material. Bower and his associates, reporting the flora in 55 patients, are in agreement so far as the aerobes are concerned.

"There are a number of reports as to the presence of anaerobes. Altemeier and Bower et al. report as to the presence of Clostridium welchii (Bacillus aerogenes capsulatus, Bacillus perfringens, Bacillus wellchii), and other observers are in accord with them in reporting a high incidence of clostridia, especially Clostridium welchii. Another clostridium occasionally present is Clostridium œdematis maligni (Vibrion septique, Clostridium septique, bacillus of malignant edema). Altemeier reports for the first time the presence of Bacillus melanogenicum in 92 per cent of patients examined. Bower et al. also report that 69 per cent of patients suffering from or recovering from spreading peritonitis had demonstrable and significant amounts of circulating antitoxin to Clostridium welchii. Jennings found Clostridium welchii in the lumen of the appendix in 90 of his cases.

"Altogether, these bacteriological studies of pus in peritonitis, complicating a perforated large intestine lesion are very disturbing to the surgeon. Most operators formerly believed that they were dealing with Bacillus coli, different strains of streptococci and an occasional staphylococcus, and many suspected that Hæmophilus influenzæ played an unknown rôle in peritonitis and appendicitis.

"But the knowledge that anaerobes are commonly present adds another factor that demands consideration. Under certain conditions, parasites attacking the tissues of the body prepare a pabulum in which the saprophytes flourish, and in addition to this the question of symbiosis demands immediate consideration. This is pertinent when it is recalled that progressive gangrenous ulceration of the abdominal wall is found in association with drainage tracts following perforated gut, especially when it is remembered that this is a symbiotic infection between specific strains of the staphylococcus and streptococcus.

"Meleney has stressed the possibility of symbiosis as an explanation of the varying behavior of suppurative peritonitis: 'In any specific prophylactic or active treatment for peritonitis one must take into account the symbiosis of the commonest organisms found in the peritoneal exudate, namely Escherichia coli, the green streptococcus and Clostridium welchii.' "

In the operative treatment of peridiverticulitis with localized abscess there will be found, occasionally, at operation very considerable thickening of the entire circumference of the gut. Even if carcinoma is suspected, resection is unwise in the presence of localized suppurative peritonitis. The patient may not have complete obstruction, but the surgeon is often uncertain as to whether the gut will become shut off or not. Under these circumstances colostomy at some distance proximal to the lesion will serve a double purpose; it will decompress the distended and partially obstructed gut and it will divert the fecal stream away from the area of infection. In peridiverticulitis with abscess formation, gentle operative manipulation confined to the immediate region of the abscess, adequate drainage, and colostomy offer an adequate operative triad, provided the patient is a reasonably good operative risk.

In 3 of the patients on whom I have operated for peridiverticulitis and thickening of the walls of the colon, there were no adhesions about the peridiverticulitis. The abscess cavity was walled off by gut wall, mesentery, and epiploic appendages, and the mesentery of the sigmoid or transverse colon was long enough to permit exteriorization of the section of gut involved. This area of intestine was delivered through the peritoneum and the parietal peritoneum was sutured lightly to the colon, the inflamed gut was left in the abdom-

inal wall outside the peritoneum and covered with thin rubber tissue to limit adhesions to the abdominal wall. Twenty-four hours later the abscess was drained. In none of these 3 cases was it necessary to do a colostomy, although it could have been easily done and after the lapse of several weeks, when the infection had cleared up, the gut was dropped back into the peritoneal cavity.

Cecostomy is not a very satisfactory way to divert the fecal stream in the colon. In acute or chronic obstruction the gut may be decompressed, and the gaseous content of the bowel will escape, but there is a tendency to the accumulation of hardened feces between the cecostomy and the site of obstruction. For this reason colostomy is the more satisfactory procedure and, if the opening in the colon is not too large, its closure spontaneously or by operation is very nearly as satisfactory as is the cecostomy opening.

If the diverticulitis is an obstructing one and suppuration is not present, resection may be the method of choice, especially if the proximal gut is not sufficiently distended with gas and filled with fecal matter as to require decompression. In my experience, however, resection without previous decompression and careful preparation of the patient for operation is a dangerous operation, unless the obstructed section of gut can be operated on after the method of Mikulicz.

In addition to the 24 cases in this report operated on in my service, I have seen in consultation 3 patients on whom resection of the sigmoid had been done in the midst of obstruction and infection, in the belief that the lesion was carcinoma. In all 3 cases no proximal cecostomy had been done for decompression, and these patients were dying of diffuse peritonitis when seen. In each instance examination of the specimen after its removal had convinced the surgeon that the changes in the gut wall were due to diverticulitis and not to carcinoma.

One of the earlier cases presented an interesting finding. The patient had been having symptoms of lower abdominal discomfort with unsatisfactory bowel evacuations. The x-ray examination showed no filling defect indicative of cancer and failed to show diverticulosis. The sigmoidoscope disclosed nothing. There were no urinary symptoms. The patient was between 40 and 50 years of age and not fat. It was thought he had recurrent appendicitis, but because his symptoms were not clear-cut a right paramedian approach was used. When the lower abdominal cavity was explored the sigmoid and cecum were found close to each other, but not adherent. On closer inspection it was seen that the tip of the appendix was adherent to an inflamed diverticulum of the sigmoid. The appendix was first freed from the cecum, its base was turned in, the diverticulum of the sigmoid was ligated close to the gut wall, and the area was covered with tags of fat. When the specimen was examined a fistulous tract ran from the appendix into the diverticulum. The condition was a chronic one. There was no suppuration and very little peridiverticulitis. This patient's convalescence was uneventful.

In another case in this group a mistaken diagnosis of early carcinoma of the sigmoid was made. There was a small area of gut wall irregularity seen in the roentgenogram on the mesial side of the sigmoid and this patient gave a history of spasm, with small amounts of blood seen occasionally in the stool. In the x-ray film the lesion was not an annular one and there were no symptoms of obstruction.

At operation a chronic diverticulitis was found adherent to one loop of small intestine. Inflammation was not active. The diverticulum was well away from the mesentery. The adhesion was freed, the diverticulum was ligated, and the base was covered over with fat tags. Because of induration no attempt was made to turn in the wall of the sigmoid. These were the only 2 cases in which any direct attack was made on the inflamed diverticulum, except in 4 patients who had early, acute diverticulitis of the cecum.

In one of these patients a clinical and x-ray diagnosis of carcinoma of the colon just proximal to the splenic flexure was made. This patient had partial obstruction. At operation a well localized diverticulitis was seen with marked edema and thickening of the colon. Because there was no general peritoneal involvement and obstruction was present, ileosigmoidostomy was done and the region of the

diverticulitis was drained by means of a stab wound through the left lateral abdominal wall just ventral to the upper margin of the lateral gutter. Although this procedure is open to criticism, the patient made a good recovery.

Attention has been called to the relative greater incidence of biliary duct diseases in patients with chronic or recurrent diverticulitis. This relationship seems clear enough.

In a patient who was being treated expectantly and who had a rather more acute attack than usual of recurrent diverticulitis, there developed acute right upper abdominal pain with the formation of a tender mass in the region of the gall bladder. This patient had multiple diverticula, but the area of diverticulitis was in the lower sigmoid. We diagnosed the right upper abdominal mishap acute cholecystitis and pericholecystitis, but were not unmindful that he might have a perforated diverticulitis in the region of the hepatic flexure. The condition increased in severity and at operation an acute, thrombotic gall bladder was found and removed.

The question of drainage in all operations within the peritoneal cavity for conditions due to infection is a matter of controversy. In all these 24 cases except the 4 cases of early diverticulitis in the cecum drainage was instituted. Three of these 24 patients died. One was an obese white woman, 73 years old, who entered the hospital with lower abdominal pain. She was a diabetic and quite ill. It was believed she had diverticulitis and she was treated expectantly. She developed pneumonia on the ninth hospital day. On the twelfth day a lower left abdominal mass appeared and increased rapidly in size. This area was operated on under spinal anesthesia and a peridiverticulitis and pelvic abscess was found and drained. She died on the fourteenth day. Whether this patient's chance of living might have been improved by colostomy soon after admission is one of the things about which surgeons are harassed, no matter what advice they give or what action they take.

The second death was in a thin man, 44 years of age, whose illness began 5 days before admission with what was diagnosed as colitis. His outstanding symptoms at onset were pain and diarrhea. Forty-eight hours before admission he became worse, with diffuse abdominal pain, distention, nausea, and vomiting. On admission he presented the picture of late, diffuse peritonitis and at operation a very large quantity of foul smelling pus was found, widely diffused throughout the peritoneal cavity. He had a perforated diverticulitis of the sigmoid with no walling off. His pelvic, right subhepatic and left subphrenic regions were drained, because pus had pooled in these areas. He improved somewhat for 2 days, but died of late diffuse peritonitis on the sixth postoperative day.

The third death was that of a very obese woman, 56 years old, who was admitted June 5, 1938, with diverticulitis and peridiverticulitis of the left side of the transverse colon. There was a large mass in this region and at operation a large abscess was found and drained through a left transverse incision. She made a slow convalescence at first, but improved later and went home. Her abdominal wound healed and she seemed in good condition. Quite suddenly, 4 months later, she became ill with abdominal discomfort. There was a chill and on admission the following morning there was a tender mass in the same region, but there were signs of diffuse peritonitis. The old incision was opened and a large abscess was found and drained. A low right McBurney incision disclosed a diffuse peritonitis with considerable free gas in the peritoneal cavity. She died of diffuse peritonitis. She had no symptoms of obstruction during her first attack, but it is possible that cecostomy or colostomy done at the time of the first operation might have promoted healing of the diverticulitis and prevented the second attack.

We have had no experience with fistulas in our cases, except the one patient with appendicodiverticular fistula. This group of patients, however, presents the most difficult operative problem in the surgical complications of diverticulitis. As a preliminary to operative attack on the fistulous tract, colostomy well away from the fistula is a wise procedure and in a number of instances will be followed by spontaneous healing of the fistula. When the fistula persists after colostomy operation is cleaner, safer, and the chance of successful closure of

fistula is better, if the bowel is decompressed and the fecal stream diverted.

CONCLUSIONS

1. Diverticulosis of the colon is present in from one-half to one per cent of all patients examined for this condition.

2. Diverticulitis is rare in patients under 40 years of age, but in patients with lower abdominal symptoms above 40 years of age diverticulosis will be found in from 5 to 10 per cent of those subjected to examination by barium enema and roentgenogram.

3. Patients older than 40 years with diverticulosis may develop diverticulitis in a disturbing number of instances, unless they take pains with their diet and regulate their bowel evacuations.

4. Most patients with diverticulitis will not develop an operative complication and are best treated medically.

5. The surgical complications are peridiverticulitis with perforation and abscess formation, diffuse peritonitis, obstruction, and fistula.

6. Diverticulitis may be acute, recurrent or chronic and may be found in any section of the colon and may involve any area in the circumference of the gut.

7. Because of the wide possibilities enumerated under 5 and 6, no single operative procedure will be found adequate for all cases.

8. In the acute cases, however, drainage and colostomy are often indicated.

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EVALUATION OF NECK DISSECTION IN CARCINOMA OF THE LIP

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THE present study was undertaken in the hope of establishing data on which can be based decisions and conclusions in regard to management of the cervical lymph nodes in carcinoma of the lip. We have studied our material from the viewpoint of the characteristics of the primary lesion and of the cervical lymph nodes as bearing on the likelihood of the presence of cervical metastases, and on the curability of such metastases if present. We have also analyzed the time of appearance of positive nodes to determine the optimum follow-up observation period; and the location of recurrences to evaluate the adequacy and extent of the neck dissection as carried out.

In recent years there has been considerable discussion in the literature on these problems. Questionnaires analyzed by the Cancer Commission of the California Medical Association (9) and by the Cleveland City Hospital Tumor Clinic (3) emphasized the wide differences of opinion which exist. While these differences of opinion, and the reasons offered in justification of the opinions, are clearly stated by Pflueger, there has been apparently a lack of specific information on which to base definite conclusions.

The material studied includes cases of carcinoma of the lip treated at the Collis P. Huntington Memorial and Massachusetts General Hospitals during the years 1922 to 1936, inclusive, and at the Pondville Hospital during the years 1927 to 1936. Since certain of the patients have been treated at more than one of these hospitals, care has been taken to eliminate duplication of cases. In the main, treatment at these hospitals has been surgical and much of the material available for the study of the effect of radiation is vitiated by lack of pathological confirmation of the diagnosis. Many of our cases have been included in previously reported end-result studies from the respective hospitals (6, 12, 13). Our present study is not primarily an end-result study. Untraced cases have been omitted as inconclusive, and many of the tables represent only that part of the total group in which information on the particular point was available. Cures in general have been followed for at least 3 years after the last treatment was given; although in some of the more recent cases this has not been possible.

Our method of treatment has consisted in surgical excision of the lesion of the lip in most instances, although in recent years there has been a considerable group treated by radiation. The neck dissection has consisted in a block dissection of the suprahyoid region, essentially as described by Kennedy, Fischel, and others. In many instances a slightly larger area has been included in the dissection, roughly as described by Blair, Quick, and Martin (8), including the upper part of the jugular chain of lymphatics to a point below the carotid bifurcation. This operation has usually been unilateral unless the primary lesion involved or extended to the midline, or unless there appeared to be bilateral node involvement. Although most of these dissections were carried out at the same time the lip operation was done, we agree with Wangenstein and Fischel that the dissection of the nodes should be deferred until the lip wound has healed. This permits reappraisal of the cervical lymph nodes after subsidence of the inflammation which is usually present in the nodes secondary to sepsis in the lip carcinoma. We have been impressed by the improved wound healing and elimination of drainage and wound sepsis in cases in which neck dissection is deferred. In a few instances very radical atypical operations have been carried

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TABLE I.—SIZE OF LIP LESION IN RELATION TO NODE METASTASES

Size	Total cases	Per cent with positive nodes	Per cent cures in positive node cases
Less than 1 cm.....	93	7·5	57
1 to 2 cm.....	328	13	55
2 to 3 cm.....	136	37	51
3 cm. and over.....	59	24	43
Total.....	616	19	51

out in advanced and apparently inoperable cases in the hope of effecting a cure, and this has been successful in some cases. We have not concerned ourselves with these exceptional cases in this study. We have accepted contraindications for neck dissection similar to those described by Quick, C. L. Martin, Leland, and others, namely fixation or extracapsular extension of metastases, or multiplicity of nodes, or clinical evidence of extensive bilateral involvement.

Size of primary lesion. Knowledge of size of the primary lesion is available in 616 cases, of which 411 patients were submitted to neck dissection. Two hundred and five patients received no treatment to the neck and were cured by excision of the local lesion except in 5 patients in whom recurrence took place in the lip. These 205 cases are included in the group without cervical metastasis in Table I.

It is evident from the table that cervical node involvement increases progressively with increased size of the primary lesion. The apparent falling off in the percentage of cervical node involvement in the lesions over 3 centimeters in extent is due to the fact that only operable cases are included in the table. Obviously very large local lesions associated with involved lymph nodes are often considered to be inoperable. Such cases are not included in the table. Hence the very large lesions included in the operable group include a higher percentage of cases of very low grade malignancy. It is also evident from the table that patients with positive nodes in which the primary lesion is large are less likely to be cured even if given the benefit of neck dissection. Nineteen patients ultimately showed recurrent disease in the lip, and in 9 instances this was associated with recurrence in the neck as well.

TABLE II.—SIZE OF LIP LESION IN RELATION TO NODE METASTASES—CASES WITH NECK DISSECTION

Size	Nodes not palpable		Nodes Palpable	
	Total cases	Per cent with positive nodes	Total cases	Per cent with positive nodes
Under 1 cm....	19	21	20	15
1 to 2 cm.....	109	15	92	30
2 to 3 cm.....	36	22	81	53
Over 3 cm.	22	18	32	30

TABLE III.—DURATION OF LIP LESION IN RELATION TO NODE METASTASES

Duration	Total cases	Per cent positive nodes
Under 1 year.....	352	14.5
1 to 2 years.....	148	21.5
2 to 3 years.....	63	33.3
Over 3 years.....	60	25.0

If attention is restricted to patients with palpable nodes who were submitted to neck dissection, the increased incidence of metastatic involvement with the larger lesions is even more emphasized. In the group of patients without palpable nodes, who were submitted to operation, the incidence of microscopic involvement is fairly constant irrespective of the size of the primary lesion (Table II).

It is evident from the table that positive nodes are clinically not discernible in about a fifth of all the cases which are submitted to neck dissection. The discrepancy between this table and Table VI below is due to the fact that Table II includes a large number of delayed and secondary cases.

Duration of primary lesion. Knowledge as to the duration of the primary lesion is available in 416 cases in which neck dissection was carried out, and in 207 cases in which no treatment was administered to the neck. Of the latter group, which is included in Table III as patients without cervical node involvement, 5 patients later died with recurrence of the primary lesion of the lip.

It is evident that the group with duration greater than 3 years has already undergone a selection, in that cases of long duration which are far advanced are not considered operable. However, the general tendency is clearly shown in the table, namely that the likelihood of cervical node metastasis is greatly increased, the longer the primary lesion is present before treatment.

TABLE IV.—GRADE OF MALIGNANCY IN RELATION TO NODE METASTASES

	Total cases	Per cent with positive nodes	Per cent cure in positive node cases
Low grade.....	348	6	36
Medium grade...	181	30	61
High grade.....	50	52	57

Grade of malignancy of the primary lesion. Grading[1] of the primary lesion was carried out in 579 cases, according to the general histological criteria described by Broders. We have classified our cases into 3 groups according to the degree of malignancy shown in the sections. In 360 cases neck dissection was carried out, while in 219 cases treatment was restricted to the lip. The results are shown in Table IV.

It is evident that the likelihood of cervical node involvement increases greatly with the higher grade lesions, and that it is very slight in the lower grade lesions. The last column in Table IV shows strikingly that cervical node involvement is just as curable when the primary lesion is of high grade malignancy as it is with low grade lesions.

Location of the primary lesion. It has been suggested that carcinoma of the upper lip is less likely to involve cervical nodes than is carcinoma of the lower lip. There were 18 instances of carcinoma of the upper lip in this series and in 9 of these cervical node metastases occurred. This is in contrast with the general incidence of node involvement of about 20 per cent for the whole series.

It is probable that when these upper lip cases are further studied as to grade, size, duration, etc., it will be found that their behavior in regard to metastases corresponds to that of carcinoma of the lip in general. Location and extent of the lip lesion also has important bearing on the location of the nodes involved in metastases, and on the decision for or against bilateral dissection.

Age of the patient. It has been stated that carcinoma of the lip is a more malignant condition in younger patients. Data in regard to the age of the patient at onset of the disease are available in 514 cases in which neck dissection was carried out (Table V).

[1]We are indebted to Dr. Shields Warren and to Dr. Benjamin Castleman for reviewing the grading of these lesions.

TABLE V.—AGE OF PATIENT IN RELATION TO NODE METASTASES

Age in years	Total cases	Per cent with positive nodes	Per cent cures in positive node cases
30 to 40.....	22	27	50
40 to 50.....	76	21	50
50 to 60.....	155	34	34
60 to 70.....	185	38	50
70 to 80.....	72	48	43
80+.....	4	75	67

It is evident that in this series of cases there is a consistent upward trend in relation of incidence of metastases to the age of the patient (15). The older age groups show a higher incidence of lymph node involvement than do the younger group. This is probably explainable on the basis of increased delay before treatment in the older patients.

Effect of recurrence of primary lesions. In a series of 276 cases in which the primary lip lesion was cured at the first attempt, nodes were found involved in 80 cases (29 per cent). In a series of 97 cases in which the lip lesion recurred after the first attempt at cure and which were later subjected to a second attempt at local cure along with neck dissection, the nodes were found involved in metastasis in 62 cases (64 per cent). Forty patients in this group were never cured of the local lesion. In cases with recurrence in the lip in which patients were finally cured, 45 patients were cured after one recurrence. In these, 12 (27 per cent) proved to have nodes involved at the time of neck dissection. In a group ultimately cured after multiple recurrences, there were 9 patients of whom 5 (55 per cent) had cervical node metastases.

These data clearly indicate the increased incidence of cervical node metastasis when the local lip lesion is not cured on the first attempt. While the increased manipulations incident to repeated attempts at cure of the primary lesion may partly account for this increase in the incidence of metastases, it is reasonable to emphasize that recurrence and repeated recurrence implies a greater total duration of the primary focus of disease, already shown to be of significance. Recurrence also implies greater invasiveness and higher grades of malignancy.

Size of the lymph nodes. In 410 primary cases the lymph nodes were described as not

TABLE VI.—METASTASIS IN IMPALPABLE LYMPH NODES

	Total cases	Per cent with positive nodes	Per cent cures in positive node cases
No primary treatment to neck..	247	8.2	15
Prophylactic neck dissection....	153	10.0	57

palpable on the occasion of the first examination. Many of the examinations were undoubtedly careless or incomplete, but at any rate it may be assumed that nodes were at least inconspicuous in these cases. Two hundred forty-seven of these patients were treated by excision of the primary lesion alone, without any primary treatment to the neck. Later, neck dissection was carried out in 25 cases because of the development of palpable lymph nodes, and the nodes proved to be positive in 20 of these and were cured in 3 instances.

One hundred fifty-three patients were treated by excision of the local lesion and primary neck dissection. Of these, 15 patients presented metastatic involvement of the cervical lymph nodes, which was cured in 9 instances. One patient who received no treatment to the neck subsequently developed fatal involvement of the cervical lymph nodes.

Results are shown in Table VI.

It is evident that in primary cases in which the nodes are not palpable there will be present microscopic involvement of the nodes in slightly less than 10 per cent of cases. In other words clinical appraisal of the absence of node involvement is subject to about a 10 per cent error. The curability of nodes is vastly lessened if the neck dissection is deferred until the involvement becomes clinically obvious. This is undoubtedly accounted for by the inclusion in the deferred group of a considerable number of neglected cases.

When nodes are palpable there seems to be a definite relationship between the size of the nodes and the likelihood of metastatic involvement (6). Consistency of the nodes is a less reliable guide, and less measurable; no attempt has been made to analyze our cases from the viewpoint of the node's hardness.

Knowledge is available as to the size of the palpable lymph nodes in 101 primary cases in which neck dissection was carried out.

TABLE VII.—SIZE OF PALPABLE NODES IN RELATION TO METASTATIC INVOLVEMENT—PRIMARY NECK DISSECTION

Size of node	Total cases	Per cent with positive nodes	Per cent cures in positive node cases
Not palpable.....	153	10	57
Under 1 cm.....	56	9	40
1 to 2 cm.....	37	60	54
Over 2 cm.....	8	75	50

Table VII shows the strikingly increased likelihood of cervical metastasis in the larger nodes. The incidence of involvement in nodes less than 1 centimeter in diameter is practically identical with the incidence in those cases in which no nodes were palpable.

The figures for cure here merit some comment. In the group of 5 patients with small nodes involved in metastasis, 2 patients died of recurrence or persistence of their primary lip disease. The rather high curability in the larger node group does not reflect a true state of affairs. Obviously, the larger nodes are more likely to become fixed or to be considered inoperable for other reasons; hence the patients who are included in the groups of larger nodes and in whom operation was done are in a sense selected. The figures do show, however, that if nodes appear to be operable, there is a reasonable chance of cure even if they are of fairly good size, provided that they are movable.

Further data as to the character and size of nodes in relation to their likelihood of harboring metastasis and their curability under these circumstances are offered by a study of the delayed neck dissection group and the group of secondary cases.

In the primary group with delayed neck dissection, in many instances patients were lost track of, and reappeared at the clinic only after nodes had progressed to the point of unmistakable metastatic involvement. When all these cases were included in a consideration of size of the nodes in relation to presence of metastasis, it is even more evident that the larger the node the more likely it is to present metastatic involvement (Table VIII).

Delayed neck dissection. Data are available in 61 cases in which neck dissection was deferred until the development of lymph node involvement had apparently occurred. While

TABLE VIII.—SIZE OF PALPABLE NODES IN RELATION TO METASTATIC INVOLVEMENT—ALL NECK DISSECTIONS

Size of node	Total cases	Per cent with positive nodes	Per cent cures in positive node cases
Less than 1 cm..	63	9.5	33
1 to 2 cm.....	57	67	53
Over 2 cm.....	23	91	43

many of these dissections were carried out promptly enough to justify designating the management as watchful waiting, others were the result of neglect or insufficient follow-up. We have assumed that a delay of 6 months or more involved an element of neglect, in contrast with neck dissections carried out within 6 months of treatment of the lip lesion. Findings in these cases are shown in Table IX.

It is apparent that clinical appraisal of the presence of lymph node metastasis is frequently erroneous even in these deferred cases. It is also apparent that when a policy of adequate surveillance can be followed, the results of deferred dissections compare favorably with those obtainable by primary dissection. On the other hand, the opportunity for cure is definitely jeopardized by neglect and inadequate follow-up.

Distribution of nodes. Although our pathological material lacks data on which to base a sound statistical conclusion, it is our impression that if a considerable number of nodes prove to be involved the prognosis is very poor.

Analysis was made of the cases with palpable nodes to determine the relative incidence of actual metastatic involvement when nodes were confined to one side of the neck, as contrasted with bilateral nodes.

Unilateral nodes were palpable and dealt with by unilateral neck dissection in 101 cases. In 43 of these there was metastatic involvement, and of these 24, or 56 per cent, were cured by operation. Bilateral palpable nodes were dealt with by bilateral suprahyoid dissection in 58 instances, and in 38, 58 per cent, metastatic involvement proved to be present. The actual metastatic involvement was unilateral in 12 cases, of which 6, 50 per cent, were cured. In contrast, bilateral metastases were found in 26 cases, of which only 5, 19 per cent, were cured.

TABLE IX.—NODE METASTASES IN DELAYED NECK DISSECTIONS

Delay	Total cases	Per cent with positive nodes	Per cent cures in positive node cases
Less than 6 mos.....	9	90	63
6 mos. and over.....	38	73	34

Thus it may be concluded that unilateral node involvement is curable in about half of the cases subjected to dissection, as opposed to one-fifth of the cases with bilateral involvement. These figures are based on delayed and secondary cases as well as primary cases. Probably the poorer results in the bilateral cases are explainable on the basis of multiple node involvement and hence the greater extent of the disease.

Fixation of nodes. Although fixation and extracapsular extension of nodes, or the involvement of nodes outside the area of usual suprahyoid dissection are commonly held to classify the case as inoperable, in certain instances radical surgery has been resorted to in otherwise favorable cases. This has been true notably in cases in which a few submaxillary nodes have been more or less fixed to the mandible, or have involved muscles in the submaxillary area. In some of these, periosteal stripping or even jaw resection or extensive muscular resection has been carried out. While in general this group of patients is incurable, and while extensive radical operations involve the hazard of an increased operative mortality, in certain cases cures have been accomplished by these methods. Such cases must be individually evaluated and do not permit statistical analysis.

We conclude that if nodes are clinically malignant and bilateral, the cases are probably too far advanced to warrant much hope of cure. Prognosis is probably better if the two sides are involved consecutively rather than simultaneously.

Location of recurrences. In the analysis of the cases which were not cured, we were struck by the large number of cases in which the result was due to failure to control the local process in the lip. Obviously cure of the primary disease is a *sine qua non* of successful management; and no neck dissection, however radical, can rectify such failure. A final ap-

TABLE X.—RESULTS IN ALL NECK DISSECTION IN WHICH LIP LESIONS WERE CURED

	Total cases	Per cent with positive nodes	Per cent cures in positive node cases
Primary cases			
Nodes not palpable.....	151	10	60
Nodes clinically benign..	90	27	80
Delayed dissection.....	17	70	33
Nodes clinically involved	85	36	55
Secondary cases.....	28	71	50
Total.....	371	27	58

TABLE XI.—APPEARANCE TIME OF POSITIVE NODES

Years after onset of primary lesion	Positive nodes present	Years after onset of primary lesion	Per cent of all cervical node recurrences
0 to 0.5.....	13	0 to .5	10
0.5 to 1	34	0 to 1	37
1 to 1.5.....	22	0 to 1.5	55
1.5 to 2	17	0 to 2	69
2 to 2.5.....	12	0 to 2.5	78
2.5 to 3	9	0 to 3	85
3 to 4	9	0 to 4	93
4+	9	Over 4	7

praisal of the efficiency of neck dissection is presented in Table X in which are presented the results in all patients subjected to neck dissection in which the lip lesion was successfully cured.

There was a small but definite incidence of deaths due to recurrent disease also in the group submitted to neck dissection in which the nodes showed no evidence of disease.

Careful study was made of the cervical node recurrences after dissection, for the purpose of appraising the extent of the operation on the neck. Knowledge for this study is available in relatively few of the patients known to have died of recurrent malignancy. A total of 31 cases are known to have developed recurrence in the field of the neck dissection. In 12 instances the neck dissections had been performed elsewhere before admission to our hospitals. In 8 other cases, recurrence in the neck operative area was associated with recurrence in the lip as well. In the 11 remaining instances, we must conclude either that the condition was too far advanced for attempted cure by dissection, or that the operation was not extensive enough, or was improperly performed. In several instances the mandible was involved, or massive implantation occurred in the operative scar. In other cases an isolated node recurrence in the submental or buccal area indicated an incomplete dissection. In these cases a secondary dissection sometimes proved effective in bringing about a cure.

In 19 patients, recurrence is known to have taken place outside the area of a routine suprahyoid dissection. In 8 of these such recurrence was part of a generalized widespread terminal involvement. Instances were noted of involvement of the pre-auricular, mastoid, low jugular, supraclavicular, and even axillary lymph nodes. Likewise we observed instances of involvement of sternum, clavicle, and upper ribs.

No relationship could be established between grade of primary carcinoma and the likelihood of developing recurrences either locally in the dissection field, or remotely. There was one operative fatality in the neck dissection series, from secondary hemorrhage.

Time of node metastases. Cases with metastatic involvement of the cervical nodes were studied to determine the time of appearance of node involvement after the onset of the primary disease. Data are available in 125 cases and are presented in Table XI.

These figures are of interest and value in determining the need for follow-up observations for patients who are not treated primarily by neck dissection. It is allowable to subtract the average of 6 to 12 months elapsing before treatment of the original lesion is undertaken. Thus 3.5 years after the lip operation 93 per cent of cervical recurrences will have taken place. It is evident that surveillance should be most intense during this period, and especially during the first 2 years, when over three-quarters of the recurrences occur.

It is impossible to emphasize too strongly that adequacy of follow-up is the determining factor in the decision for or against prophylactic neck dissection in many cases. A policy of watchful waiting in regard to the neck is justifiable only if the patients will report regularly and conscientiously for examination. Ignorant or irresponsible patients, and those who live at remote points or for whom transportation problems are difficult, should not be trusted to report regularly. Likewise insufficient or undependable social service

TABLE XII.—THIRD ORDER ASSOCIATIONS—SIGMA $X^2(n=8)$

	High malignancy	Large size	Long duration	Positive nodes
Palpable nodes..	11.14	27.40	8.08	91.78
High malignancy		31.43	6.46	86.84
Large size.....			19.22	12.13
Long duration ..				7.30

follow-up, crowded and undermanned clinics, and hurried or perfunctory examinations militate against the success of a policy of deferred neck dissections.

Of the 9 patients in whom metastases took place after 4 years, several of the patients presented abnormally long durations of the primary lip lesion when they first presented themselves for treatment. In 4 instances cervical metastasis did not appear until over 8 years after the onset of the original lesion.

EVALUATION

On the basis of the data presented in Tables I to X it seems apparent that positive cervical lymph nodes are associated with lip lesions of longer duration, larger size, and higher grades of malignancy. Certainly if we assume that carcinoma starts as a localized process which forms metastases only after an interval of time, it is a necessary corollary of this assumption that the longer a lesion is present, the more likely it is to present metastases. The size of a carcinoma is influenced by its rapidity and mode of growth, and by its duration. Thus it is reasonable to associate increased likelihood of lymph node metastasis with increased size, both because of the implied greater duration and because of the greater rapidity of growth. Grade of malignancy is based on histological criteria which evaluate rapidity of growth, invasiveness, lack of host resistance, etc., which may be anticipated to influence the development of node metastases, and to be closely related to the size of the lip lesion, and to the tendency to recur locally after excision. The observed increased incidence of cervical node metastases in patients presenting recurrence of the primary growth in the lip seems definitely to relate to the increased duration and greater invasiveness of the local disease in these cases. The outstanding characteristic of the lymph nodes which is associated with metastatic involvement is the size of the nodes. Although our figures indicate a considerable fallibility of clinical appraisal, it is obvious that the presence of enlarged lymph nodes is our most dependable clinical evidence of metastatic involvement.

For further statistical analysis of the significance of these factors, we subdivided our cases according to the following schedule:

Duration—Short: less than 1 year
Long: 1 year or more
Size —Small: less than 1.5 centimeters
Large: 1.5 centimeters or larger
Grade —Low: Grade I
High: Grades II and III
Size of nodes—Not palpable: less than 1 centimeter
Palpable: 1 centimeter or larger
Pathology of nodes—Negative
Positive

These tabulations were submitted for analysis of partial associations, which are presented in Table XII[1].

Thus by holding the various combinations of variables constant, associations are found to exist between palpable nodes and large size, palpable nodes and positive nodes, high malignancy and large size, and high malignancy and positive nodes. In addition a border line association is found between large size and long duration. Apparently large size has not been demonstrated to be of consequence except when it is associated with high malignancy or palpable lymph nodes. The border line association between duration and size is simply confirmation of the clinical fact that carcinoma grows larger the longer it is present. It is regrettable that statistical confirmation of the relation of duration to cervical node involvement is lacking. It is first of all to be remembered that data as to duration are extremely undependable. Secondly, it is probable that the interval of 1 year used as a dividing line between cases of long and short duration is too great. At the expiration of a year probably metastases have already occurred in practically all cases which tend to develop them. Finally, the degree of malignancy is of such overwhelming importance as to overshadow the significance of duration. It should

[1]For the statistical analysis on which this table is based, we are indebted to Dr. H. L. Lombard, director of the division of cancer and other chronic diseases of the Massachusetts Department of Public Health.

be realized that classification of cases according to two or three grades of malignancy is purely arbitrary; and that undoubtedly there are a large number of possible subdivisions in each of these grades. If a group of cases could be selected which was homogenous so far as its degree of malignancy was concerned, and if accurate data in regard to duration were available in terms of months, it is probable that confirmation of the significance of duration in relation to metastases could be secured.

The association between grade of malignancy and positive node involvement is very marked; even though for the purpose of the analysis Grades II and III were grouped together as high malignancy.

Indications for neck dissection. On the basis of the findings here recorded, it is possible to offer indications for carrying out neck dissection.

1. Cases without palpable lymph nodes, or with nodes less than 1 centimeter in size. Provided this group of cases can be followed carefully, there does not seem to be sufficient likelihood of the development of cervical metastasis to warrant routine dissection. Prophylactic dissection is justifiable in highly malignant lesions, and in patients who for various reasons cannot be kept under proper surveillance. While our group with deferred dissection yielded fewer cures, it is probable that the explanation for this lies in the number of cases which really represented neglect, permitting the nodes to attain large size before dissection was carried out. Follow-up must be most intense for at least 3 years after the local lesion has been cured, if cases are to be treated expectantly. We believe that observations should be monthly for at least 6 months after lip treatment, and bimonthly thereafter for 2 years.

2. Cases with lymph nodes larger than 1 centimeter. These patients should be given the benefit of neck dissection as part of the original treatment. We do not advise the treatment of the lip and neck at a single sitting. We believe that proper procedure consists in the following steps: (a) biopsy; (b) dental clean-up, extractions, treatment of pyorrhea, etc. At the same time an attempt can be made to combat sepsis in the local lesion; (c) eradication of the local lesion by radiation or operation; (d) after healing of the wound of lip operation, or subsidence of most of the radiation reaction, the nodes should be reappraised as to size, consistency, etc.; (e) neck dissection should then be carried out if the enlarged nodes persist, and especially if there is asymmetrical enlargement. In doubtful cases, dissection should be carried out if the primary lesion is of a higher grade of malignancy, or if it is a recurrent process in the lip. Dissection should also be considered in doubtful cases if the lesion is of large size, long duration, or of invasive character. It should be remembered that a small biopsy or a single section may not give a true picture of the grade of malignancy; and due weight should be given to strictly clinical characteristics commonly associated with rapid growth.

3. Neck dissection should not be carried out unless there is a considerable degree of confidence that the local process in the lip has been or can be cured.

4. The routine suprahyoid dissection, unilateral unless the lip lesion extends to the midline, is probably as extensive operation as is necessary, provided it is properly performed. When there is obvious node involvement, a more extensive operation may be desirable.

5. Follow-up observations should be carried out intensively after neck dissection, with special attention to lymph node areas of the opposite side of the neck, and beyond the limits of the dissection. Secondary dissections are often successful if they are undertaken promptly.

6. It is difficult to define the border line between operability and inoperability in the cervical nodes. Fixation of nodes to the jaw or muscles or great vessels, extracapsular involvement, or multiplicity of nodes, especially if bilateral, argue for incurability. While occasional brilliant results may be achieved in apparently incurable cases by very radical procedures, such as jaw resection and the like, it is doubtful whether enough such favorable results ensue to justify the greatly increased operative mortality which inevitably follows the frequent employment of these measures. We have had no experience with combinations of surgery and interstitial radiation such as

advocated by Quick, Martin (8), and others. Our impression is that cures are not effected any more often by this method than by some of the very extensive surgical procedures that are sometimes successful.

7. Our method of management of cases with inoperable cervical node metastases has been by x-ray therapy. So far as we are aware, we have not cured, by this method, very many patients with known metastatic involvement.

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CLINICAL SURGERY

FROM THE ROYAL NORTHERN HOSPITAL

PER-URETHRAL RESECTION OF THE PROSTATE

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THE operation of transurethral resection of the prostate has now established for itself a definite place in the surgery of the prostate. The indications for its use have become more clearly defined, and the technique, although it may differ in certain details in different clinics is more uniform. It is possible, therefore, to speak with greater confidence and conviction of this operation than would have been justifiable even so short a time ago as 3 years.

DANGERS AND POSSIBLE COMPLICATIONS OF THE OPERATION

As in the case of the operation of prostatectomy the chief dangers to be feared are hemorrhage, sepsis, and renal failure. There are, however, a few special complications that may follow a per-urethral resection, such as the formation of a recto-vesical, or more commonly a recto-urethral, fistula and stricture due to trauma of the urethra. These complications will be dealt with in greater detail in the section of this article devoted to pre-operative and postoperative treatment. At this juncture all that need be said is that the severity of sepsis following a per-urethral resection depends to a large extent on the amount of damage inflicted on the tissues. If electrocoagulation has been extensive, or if much trauma has been inflicted on the urethra by the passage of a large caliber instrument, sepsis is likely to be severe. If, on the other hand, only that amount of coagulation has been carried out that is necessary to control hemorrhage, and if the size of the instrument is such as to inflict the minimum of trauma on the urethra, sepsis will be inconsiderable. It is the recognition of this principle that has led to the abandonment of many methods of resection which were the forerunners of the technique about to be described.

PREPARATION OF THE PATIENT

The fact that compared with total prostatectomy, per-urethral resection is a minor proceeding does not absolve the medical man from taking the same amount of care over pre-operative measures that he does in the case of the major operation.

Of chief importance in this pre-operative care is the welfare of the kidneys. The commonest cause of death after both operations is renal failure. If, therefore, more than a few ounces of residual urine are present in the bladder, time must be given for the recovery of the kidneys by the use of an indwelling catheter. Should a large quantity of residual have been present for a long time, drainage must be preceded by gradual decompression of the bladder. Any method of tying in the catheter that ensures its remaining in position may be employed. Personally, I use the technique shown in Figure 1. The use of wire pipe cleaners rather than tape, allows of their being bent so that no pressure is exerted on the sensitive glans penis, and this insures greater comfort to the patient.

The duration of the preliminary drainage of course will depend upon the amount of impairment of the renal function. In judging this, the clinical condition of the patient, the total quantity of urine passed in 24 hours, its specific gravity, and results of the laboratory renal function tests must all be taken into account.

In my own clinic I place the greatest reliance on the estimation of the blood urea, and on the urea concentration test. The method of carrying this out is to administer 15 grains of urea by the mouth and then to estimate the urea content of the urine during the first, second, and third hours. If the percentage is over two, the renal function may be regarded as normal; if between one and two, impaired; if under one, damaged. It must be remembered, however, that various factors, besides the efficiency of the kidneys may influence the percentage of urea in a given specimen of urine. Chief among such factors is the quantity of water excreted. In the presence of polyuria, a low concentration figure will be given. It is bet-

Fig. 1. Method of tying in catheter with wire pipe cleaners.

ter, therefore, to rely on the total quantity of urea excreted rather than on the percentage, and to regard the result of the test as bad unless more than one-tenth of the original dose of urea be eliminated in each hour. In assessing the result of the blood urea, it must be remembered that a rise is likely to occur only when the damage to the kidney is considerable. A percentage of urea below 50 is therefore no proof that the renal function is unimpaired. If, however, the reading is over 50, this will constitute definite evidence that the kidneys are deficient.

It cannot be emphasized too strongly that the results of the renal function test must always be correlated with information obtained from the clinical examination of the patient. However valuable the aid that the laboratory lends, it is upon the clinical examination of the patient that the final decision as to whether it is or is not safe to operate, finally rests. The fallacies that beset all renal function tests are numerous, most of them being due to the fact that the kidneys do not work at full pressure; in other words, their potentiality is greater than that shown by any given test. It is this failure on the part of laboratory tests to estimate satisfactorily the reserve power of the kidney that is their chief limitation.

During the period of preliminary drainage everything should be done to encourage urinary excretion by the ingestion of larger quantities of fluids. As a rule, all that is necessary is to instruct the patient to drink as much between meals as possible. Should, however, the fluid intake still remain unsatisfactory, fluid must be administered by other routes (per rectum, subcutaneously, or, in serious cases, intravenously).

THE INSTRUMENT

The instrument that has superseded all others in my own clinic for per-urethral resection of the prostate is a modification of the McCarthy resectotome (Fig. 2). The majority of these modifications have been introduced by Mr. Ogier Ward and Mr. Schranz of the Genito-Urinary Manufacturing Company (Fig. 1). The sheath, as in the case of the more recent American types is metal outside with the exception of the bakelite beak, a modification that allows of easier introduction. The length of the beak has been shortened, and to the end of it has been fitted an inclined plane which has the effect of pushing forward the loop, as this is wound out of the sheath into the cutting position. Not only does this allow of its taking a wider sweep, but also of its remaining in the field of view, and under better control. The two taps on the irrigating channels have also been replaced by a single stop-cock, which, according to its position allows of inflow or outflow only, or else shuts off altogether the irrigating fluid. This is a considerable advantage in an operation in which attention has to be directed to so many different details. Since larger pieces of prostate can be cut away through the wider excursion of the loop, it is possible to work with a smaller sheath than formerly was the case, and one of the No. 26 Charrière scale will be found to be very efficient. Through the use of a smaller instrument this risk of damage to the urethra is considerably lessened.

TECHNIQUE OF OPERATION

Not only has the resectotome been considerably modified but also the technique of the operation. If a sagittal section of the bladder, urethra, and rectum be examined (see Fig. 3) it will be seen that there are two areas of danger, that is to say positions, in which the loop, if it makes too wide an excursion, runs the risk of cutting into important structures. The first of these is in the region of the trigone. Resection here may end in the subtrigonal structures being exposed and in the operation being followed by extensive suppuration in the space of Denonvilliers. I am convinced that certain instances of long continued suppuration among my earlier cases were due to infection of this space. The second dangerous area is the junction of the prostatic with the membranous urethra. It is in this area that the urethra lies in closest proximity to the rectum. In 2 of my cases resection has been followed by the passage of urine per rectum. Fortunately, the recto-urethral fistula so formed soon healed spontaneously, in one case, through the help of a temporary suprapubic drainage, and in the other by means of the indwelling catheter alone.

If these two complications of extensive suppuration and recto-urethral fistula are to be avoided, great control must be exercised over the excursion of the loop. The danger area of the junction of the prostatic and membranous urethra can be avoided by keeping the upper part of the

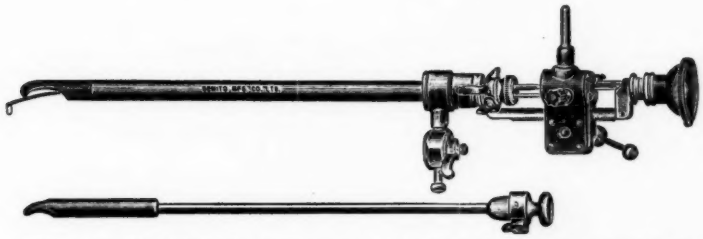

Fig. 2. Modified McCarthy instrument. An inclined plane has been fixed to the beak of the sheath which has the effect of pushing the loop forward. For the inlet and outlet irrigating channels a single control has been substituted.

verumontanum as a fixed point throughout the operation, and never extending the cuts below this level. The second danger of opening into the subtrigonal tissues is avoided by adopting what Mr. Ogier Ward has termed "the method of subvesical resection of the prostate." In introducing this technique, he has pointed out that after the operation of prostatectomy by enucleation, the space that is left is quite different from that left after an ordinary per-urethral resection. The cavity from which the prostate has been enucleated connects with the bladder through a comparatively small opening, and little if any damage has been inflicted on the trigone. If, in carrying out a per-urethral resection we imitate this condition, and instead of allowing the loop to inflict damage on the trigone with each cut, only allow it to enter the bladder in the mid-posterior line, not only will the risk of severe sepsis be avoided but also the highly vascular trigonal mucosa be left undamaged. To achieve this, it is necessary to resect tissue from around the prostatic urethra and from beneath the trigone without cutting into or in any way damaging this structure, except to a very limited extent in the neighborhood of the posterior midline.

The resection is carried out as follows: Beginning in the mid-line posteriorly, the loop is first placed over the intravesical projection in the usual manner, until it is hidden from view; one or two such cuts are usually all that is necessary. After this, the loop is not again allowed to enter the bladder cavity, but from now onward is kept in sight; pressed against the prostate itself within the urethral cavity and at a level immediately below that of the internal meatus. Simultaneously with the turning on of the current, the loop is embedded in the tissues by pressing the beak of the sheath firmly in the required direction, and making the cut from there downward to the upper limit of the verumontanum. These cuts resect chiefly the lateral lobes, but must be continued well round, so as to include the front of the gland on both sides. From time to time hemorrhage is stopped by the substitution of the ball electrode for the loop, and the coagulating for the cutting current. At the end of a per-urethral resection conducted in this manner, if the instrument be withdrawn so that the objective of the telescope lies at the level of the verumontanum, one finds oneself looking into a recess which has been excavated beneath the bladder, and at the top of which there is to be seen a comparatively small opening into the bladder; in other words, the condition produced is very similar to that existing after an enucleation. Sooner or later a stage is reached when further cutting into the lateral lobes becomes mechanically impossible. The operation may now be considered to have been completed.

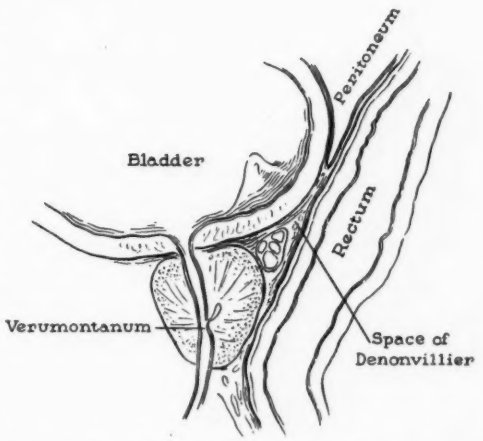

Fig. 3. Sagittal section through prostate and rectum showing the space of Denonvilliers lying beneath the trigone and the proximity of the rectum to the urethra at the apex of the prostate.

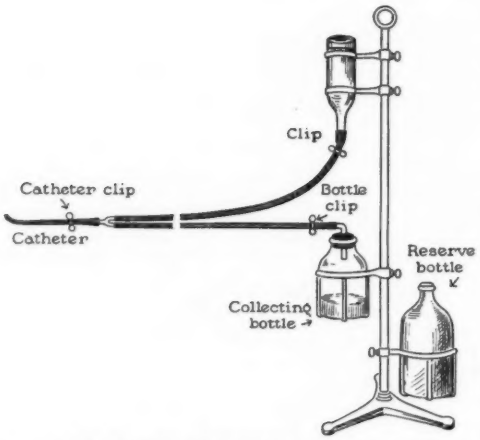

Fig. 4. Mark's hospital irrigating system for indwelling catheters.

One of the difficulties that operators have always experienced has been the extraction of cylinders of tissue that have fallen into the bladder. A variety of patterns of forceps have from time to time been advised for extracting these, but in my opinion the easiest method is that practiced with the new form of McCarthy resectotome. The telescope and loop are removed and a connecting piece between the sheath and a Bigelow evacuator are fitted on. This allows of fragments of prostate that have fallen into the bladder being sucked into the bulb in the same way as fragments of stone are extracted during the operation of lithotrity. It is of importance that this extraction be thorough, since the eye of the indwelling catheter will otherwise be occluded during the subsequent drainage.

Anesthesia. I much prefer for anesthesia the use of a low spinal anesthetic. Not only does this obviate any necessity on the part of the operator to conclude the operation within the shortest time possible, but it reduces the likelihood of hemorrhage. In a resection carried out under a general anesthetic, bleeding is always more marked than in one performed under spinal anesthesia. The only disadvantage of a spinal anesthesia is that the vasoligature performed after resection, in order to reduce the risk of epididymitis may not be entirely painless. This disadvantage, however, can easily be overcome by the additional use of a local anesthetic. It is, in my opinion, an advisable step in the operation, since the risk of epididymitis appears to be at least as great after per-urethral resection as after prostatectomy. In one very bad case, a patient with severe myocardial degeneration, operated on by me, I omitted this step; although patient withstood the shock of the resection, he died 3 weeks later from a suppurating epididymitis.

POSTOPERATIVE CARE

The final step in the operation has been the tying in of an indwelling urethral catheter. For this purpose I generally use a whistle ended rubber catheter with two lateral eyes. This can be inserted through the sheath before it is withdrawn, and is tied in in the same way as a catheter used before operation. As soon as the patient has returned to bed the catheter is connected up with a St. Mark's Hospital irrigating apparatus (Fig. 4). This allows of the bladder being washed out frequently simply by manipulating the two clips on the rubber tubes fitted to the Y-shaped connecting piece. It is the duty of the nurse to ensure that drainage is satisfactory and that the catheter has not become blocked by blood clot. If due attention has been paid hemostatis at the conclusion of the operation, this is easily achieved, and in 24 or 48 hours all bleeding will have stopped. The precise nature of the antiseptic employed is of less importance than its mechanical action in washing out the bladder. Whenever bleeding is greater than it should be, an occasional wash-out with hot silver nitrate is useful as a hemostatic measure.

Since the maintenance of a good output of urine is an essential part of postoperative treatment, it is important that the patient should be encouraged to drink as much fluid as possible. Should the intake be unsatisfactory, the oral fluids must be supplemented by fluids administered per rectum, subcutaneously, or, in more urgent cases, intravenously.

The length of time that the catheter is left in the urethra will depend on several factors: the duration of hemorrhage, the severity of sepsis, and the amount of tissue resected at the operation. If the patient is comfortable and no urethritis is present, I prefer to leave the catheter in position for a week or even 10 days. When it has been withdrawn, continuous drainage is replaced by intermittent catheterization in order that the amount of residual may be measured, and the bladder washed out. Only when the emptying of the bladder is considered satisfactory and the urine clear, should the patient be discharged from hospital.

COMPLICATIONS

The main complications of a per-urethral resection, renal failure, sepsis and hemorrhage, have

already been dealt with. All that need be referred to here is the treatment of cases in which hemorrhage and sepsis are so severe as not to respond to usual methods.

Severe hemorrhage may be either reactionary or secondary, but the former will seldom be met with if proper attention has been paid to hemostasis before the patient leaves the operating theatre. The main anxiety of the medical man responsible for the safety of the patient who is bleeding more than he should is to maintain the bladder drainage. Fortunately, the type of catheter used allows of clots being ejaculated through the terminal opening by the use of a bladder syringe. It may happen, however, that so much bleeding has taken place as to cause clot retention. Before resorting to opening the bladder above the pubis, it is worth while attempting to digest the clot by injecting 2 ounces of glycerine of pepsin. In certain cases it will be found that after injecting this fluid the clots have been sufficiently digested to allow of their evacuation through the catheter. If, however, catheter drainage is no longer satisfactory, no hesitation need be felt in opening the bladder above the pubis and inserting a tube.

Serious sepsis must be treated by frequent bladder irrigation and by the use of either calcium mandelate or sulfanilamide. Should severe infection have occurred prior to operation, and the patient be of the type who will resent the presence of an indwelling catheter, it is better to carry out a preliminary drainage in order to get the bladder into a healthier condition. Provided all obstruction has been removed, a suprapubic fistula will close within a few days of the removal of the tube, and the duration of convalescence is very little increased by the carrying out of a suprapubic drainage. No hesitation need be felt, therefore, in making this addition to the operation if the patient be intolerant of instrumentation, if a prolonged period of drainage be necessary, if pre-operative sepsis is severe, or if hemostasis at the conclusion of the resection is considered unsatisfactory.

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TECHNIQUE OF SUBTOTAL GASTRECTOMY FOR ULCER

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DURING the past few years there has been a gradual but very definite change in the method of handling the patient with gastric and duodenal ulcer. There has been the change from the situation in which opinions were divergently divided into those advocating surgery for nearly all ulcers and those advocating non-operative measures except when urgent complications such as perforation, obstruction, or malignant degeneration occurred. There is very little disagreement today with the more modern attitude that no ulcers are primarily surgical, that all ulcers should be given a trial of non-operative treatment, and that all patients with ulcers should have surgical treatment only as the ulcers fail to respond under the trial of medical measures. Practically everyone is in agreement with the surgical indications which we have frequently discussed, namely, ulcers which are intractable to medical management, those in which two or more gross hemorrhages have occurred in spite of good treatment, those which have perforated, pyloric obstruction which is not amenable to medical management, and gastric ulcers in which the question of malignancy cannot be definitely settled.

Although the relationship of surgery to non-operative measures has been quite definitely established, there has been lack of agreement during the past few years as to the desirability of employing conservative operative procedures such as gastro-enterostomy, gastroduodenostomy, or various forms of pyloroplasty with or without the excision of the ulcer or whether or not more radical procedures such as subtotal gastrectomy should be employed.

It seems to us that subtotal gastrectomy has now been more and more generally accepted throughout this country and England, the two countries in which acceptance of the method, when first advocated by continental surgeons, was most strenuously resisted.

There were certain psychological reasons that made the acceptance of subtotal gastrectomy for peptic ulcer difficult for all of us. It was particularly difficult for everyone to accept the plan of removing large portions of the stomach for an ulcer no larger than one's little finger nail. It was particularly difficult also to accept this procedure when many of the patients with the lesion, although uncomfortable, were able to be up and about and, with the aid of alkalies and frequent feedings, to struggle through the years, suffering only periodic attacks of discomfort and disability. It was further difficult to accept this radical operative procedure because up to the time that one becomes expert with it, the mortality rate is distressing and a fatality in a patient, who is not in a condition of acute abdominal emergency, who is able to be up and around and at times at least to support himself partially, is a particularly depressing and distressing one. For these reasons it was but natural that subtotal gastrectomy, as a method of surgical treatment for gastric and duodenal ulcer, was accepted only after having met with considerable resistance and among the prominent resisters it is but fair to say that we ourselves were included.

Haberer and Finsterer who did pioneer work in Europe and in this country, and Berg, Lewissohn, and Strauss deserve a great deal of credit for their persistent advocacy of this method of surgical treatment in the face of vigorous and at times almost bitter criticism.

It is being more and more accepted, as we have repeatedly said, that conservative surgical procedures, such as gastro-enterostomy and pyloroplasty, are no longer justifiable as routine operations for patients with gastric and duodenal ulcer. The too frequent occurrence of gastrojejunal ulcer, so intractable to medical management, and the occasional incidence of gastrojejunocolic fistula, a lesion with a disturbing mortality rate, has led a great many surgeons to avoid the routine use of these conservative procedures.

While we feel entirely in sympathy with the selection of subtotal gastrectomy as the method of choice in the surgical treatment of duodenal and gastric ulcer, nevertheless we think that lest our attitude be misinterpreted it is but fair to say that occasional cases will arise in which it would be unsafe and unwise to apply subtotal gastrectomy. It would be a mistake, we believe, for anyone dealing with gastric and duodenal ulcer to take the attitude that all patients with

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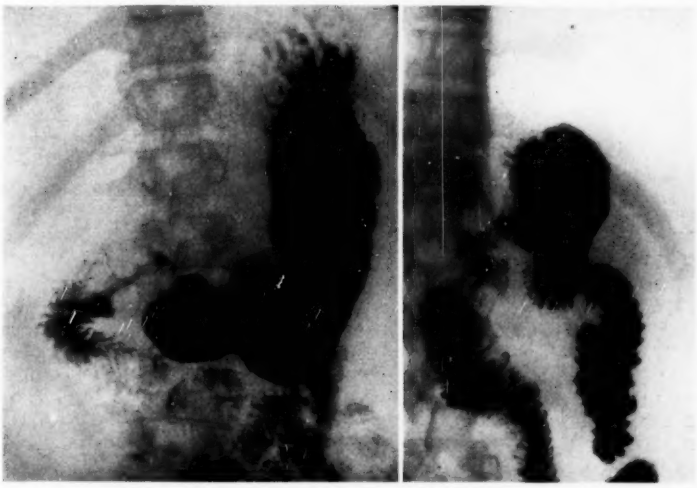

Fig. 1. This roentgenogram shows the small amount of stomach left after the subtotal gastrectomy now employed at the clinic. Note how well these anastomoses without entero-enterostomy drain.

gastric or duodenal ulcer regardless of their age, condition, weight, or location of the ulcer should be submitted to subtotal gastrectomy. We believe very strongly that in bad risk cases it is infinitely better to perform an operation with which one is not as well satisfied but to which is

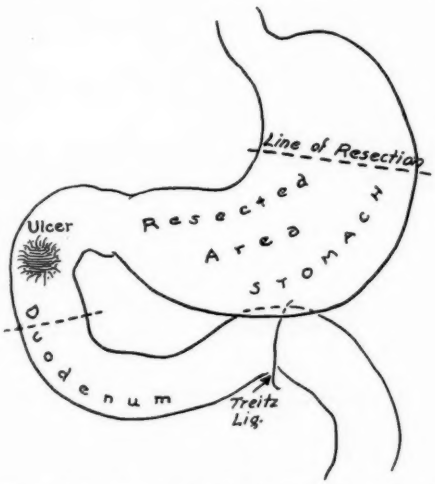

Fig. 2, left. A diagrammatic sketch solely to demonstrate the amount of stomach and duodenum resected.

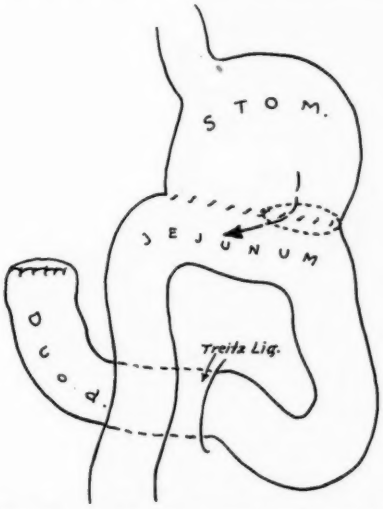

Fig. 3. Diagrammatic sketch of the principle of the Hofmeister procedure. Note the closure of the upper half of the transected stomach, the anastomosis established at the lower half, and the loop of the jejunum buttressed over the upper closed half of the stomach. In this illustration the proximal portion of the jejunum is shown attached to the greater curvature of the stomach. This is occasionally done when the position of the jejunum is such that the jejunum falls naturally in this relationship, but more frequently the proximal loop of the jejunum is anastomosed to the lesser curvature of the stomach.

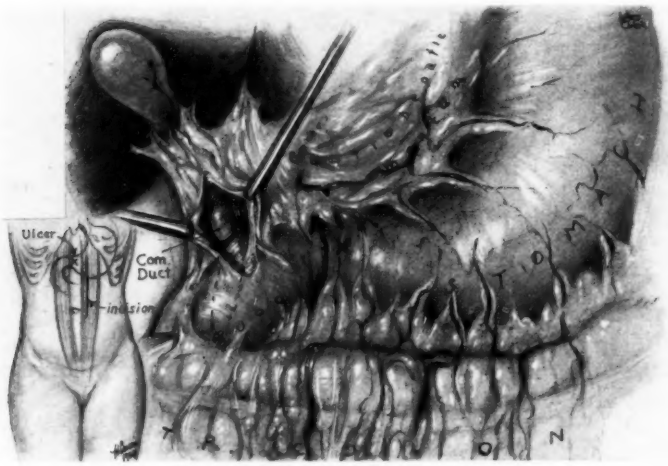

Fig. 4

Fig. 4. In the insert shown in the lower left hand corner, the relation of the incision to the stomach and duodenum can be seen. We have routinely employed a left rectus incision because it permits an easier approach to the gastric vessels high up on the lesser curvature. With the traction tape applied to the stomach, as is shown in Figure 5, the duodenum is pulled up and toward the middle line, so that approach to it through the left rectus incision is quite easy. Although resection can be done readily either through a midline or right rectus incision, it is our experience that it is easier to mobilize the duodenum toward the left and to deal with it satisfactorily than to mobilize high levels of the lesser curvature and the esophagus to the right and to deal with them satisfactorily through a right rectus incision. In the main illustration, note that particularly in duodenal ulcers one of the first things accomplished is to establish the relationship of the ulcer in the duodenum to the common bile duct. This is most important. We have seen duodenal ulcers so close to the common bile duct that when the duodenum was resected, unsatisfactory amounts of duodenum remained to be turned in. For that reason one of the first steps in total gastrectomy is to demonstrate the relationship of the ulcer to the common bile duct.

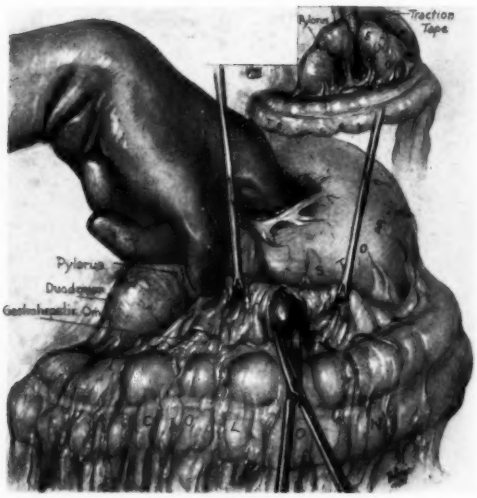

Fig. 5

Fig. 5. The finger is shown entering the lesser peritoneal cavity by breaking through the gastrohepatic omentum and emerging through the gastrocolic omentum. Note in the insert the introduction of a strip of gauze, traction upon which pulls the duodenum up out of its deep location in the right upper quadrant so that the duodenum approaches the midline and can be dealt with readily. This greatly simplifies exposure of the duodenum.

attached a lower mortality rate. We believe from our experience that occasionally there are patients with indurated ulcers, low in the duodenum, close to and even involving the common bile duct, with a marked degree of pyloric obstruction, in whom subtotal gastrectomy cannot be done with safety because of the fact that there would be insufficient duodenum left for safe inversion of its end. In such a patient the operation of Finsterer here described in Figure 16, in which the ulcer is left in place, occasionally cannot be done because of the fact that the pylorus is obstructed and the remaining stump, therefore, will not drain. We think that every patient with ulcer who is approached surgically should be considered as to the possibility of subtotal gastrectomy and estimated

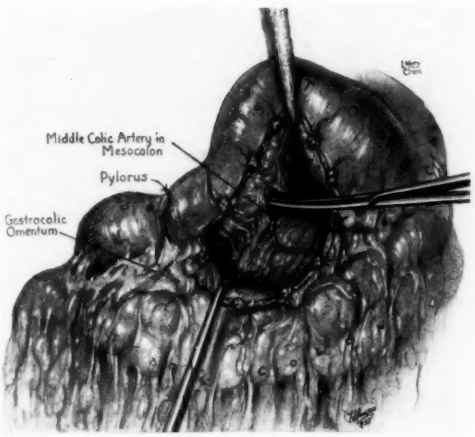

Fig. 6

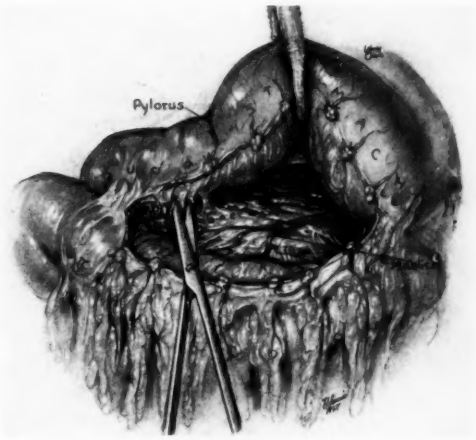

Fig. 7

Fig. 6. Partial ligation of the vessels in the gastrocolic omentum and the separation of the lower end of the stomach from its attachment to the pancreas is shown. Note again the value of the traction tape.

Fig. 7. Further ligation of the vessels along the greater curvature. Note now the separation of the duodenum from the head of the pancreas. Separation of the duodenum from its retroperitoneal attachment is accomplished much more easily from below upward by rolling the duodenum upward than from above downward.

Fig. 8. With the vessels in the gastrocolic omentum ligated and the duodenum freed from below and behind, the vessels of the lesser curvature in the gastrohepatic omentum are now ligated. Note the dotted line showing the level at which the stomach is to be resected. Note also that the peritoneum has been incised over the common bile duct to show its relationship to the ulcer.

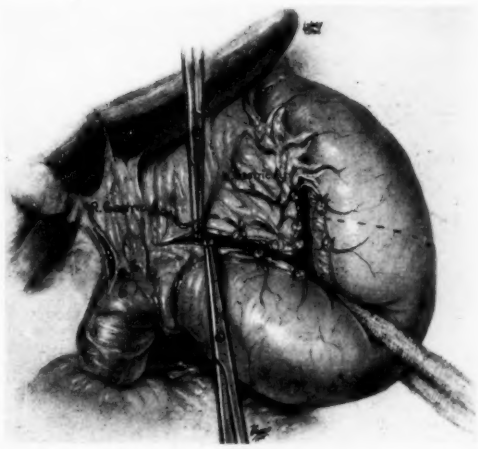

Fig. 8

upon the basis of his general condition, age, weight, and the location of the ulcer, and then only should the operative procedure be selected.

In a follow-up study of 200 cases in which subtotal gastrectomy has been done for ulcer it has been demonstrated to us that the end-results, at least so far, are superior to those obtained by the use of the more conservative procedures, namely, a gastro-enterostomy or pyloroplasty. There are fewer recurrent ulcers and the incidence of digestive difficulty after operation is also greatly lessened.

It has seemed to us that it would be of value to present in illustrations and legends the technique of the now relatively standardized subtotal gastrectomy to which we have come after a considerable experience with various types of operative procedures. Up to September 28, 1938, we have handled 362 cases.

It has also seemed to us that it might be of value, comfort, and perhaps encouragement to other surgeons to report our mistakes and to state that there has been no operation in our experience in which it has been more difficult for us to overcome complications and in which it has been more difficult to reduce mortality than in that of subtotal gastrectomy. It seems to us that there is no operation in which a relatively large experience and frequent practice is more important and more necessary than that of subtotal gastrectomy if the mortality rate is to be reduced and kept low.

There is no operation with which we have had experience in which co-operation between gastroenterologists in the preparation of the patient and

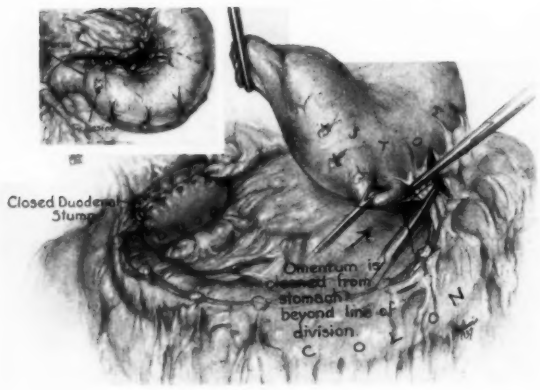

Fig. 9

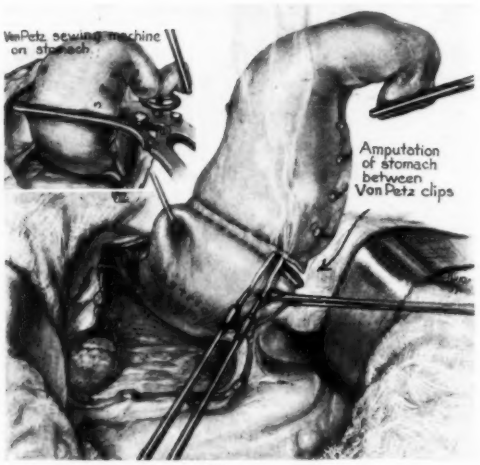

Fig. 11

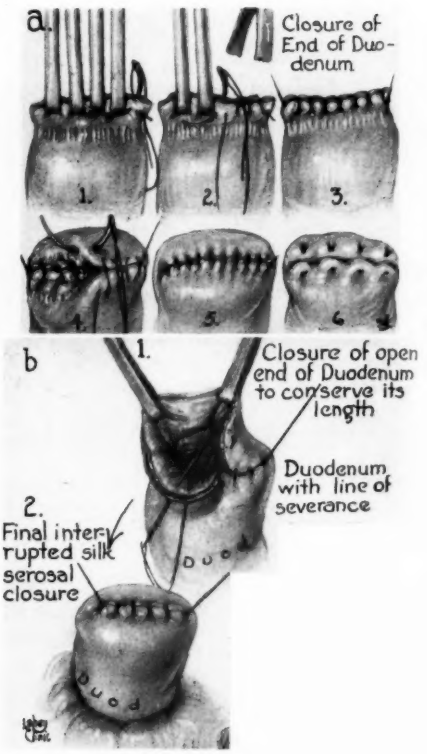

Fig. 10

Fig. 9. In the insert in the upper left hand corner the stomach is shown freed and with all of its vessels ligated. In the main illustration the duodenum has been severed and turned in, and a few more vessels are being ligated in the gastrocolic omentum to control all blood supply up to the level of the dotted line shown in the insert, the level of transection of the stomach. Note in the main illustration the relationship of the middle colic artery in the mesentery of the transverse colon.

Fig. 10. The two methods employed in closing the duodenal stump, a and b. The duodenum is grasped between 2 Ochsner clamps and severed between these clamps with the cautery, the ends being sterilized, care being taken to leave in the lower clamp a small grasp of duodenal tissue. The free duodenal tissue projecting above the level of the clamp is then clamped with a row of Allis forceps. The first Allis forceps, as shown in a, *1*, is taken off and a continuous catgut stitch continued. As each Allis forceps is taken off a lock stitch is applied until the entire duodenum is closed. A continuous catgut stitch now buries this crushed region and a reinforcing layer of interrupted silk mattress stitches is then applied. In b, the method now most commonly employed in this clinic is shown. As in a, the duodenum is grasped by 2 Ochsner clamps and is severed by burning with the cautery between these two clamps, and the lower clamp is removed. Following the removal of the Ochsner clamp, the ends of the duodenum will remain stuck together. Allis forceps are used to pick up the duodenum; one end is gently opened and a suction apparatus is immediately introduced to suck out its content. The open end of the duodenum is then inverted by a continuous Connell in, out, and over stitch. This is returned to invert the first layer, and a third layer of interrupted mattress silk sutures, as shown in b, *2*, is then introduced.

One of the most important steps in subtotal gastrectomy is the preservation of sufficient duodenal stump so that it can be accurately inverted and adequately sutured so that there is no danger of leakage from it. Either of these methods preserves the entire available duodenum. The method which involves over and over suture of a clamped duodenum using up from ½ to 1 inch of the duodenum may result in such a short stump of duodenum remaining that inversion and closure must be done under tension.

Fig. 11. With the duodenum closed and with the blood supply of the stomach ligated, the stomach is turned upward over the left edge of the wound and, as shown in the insert in the upper left hand corner, the von Petz sewing

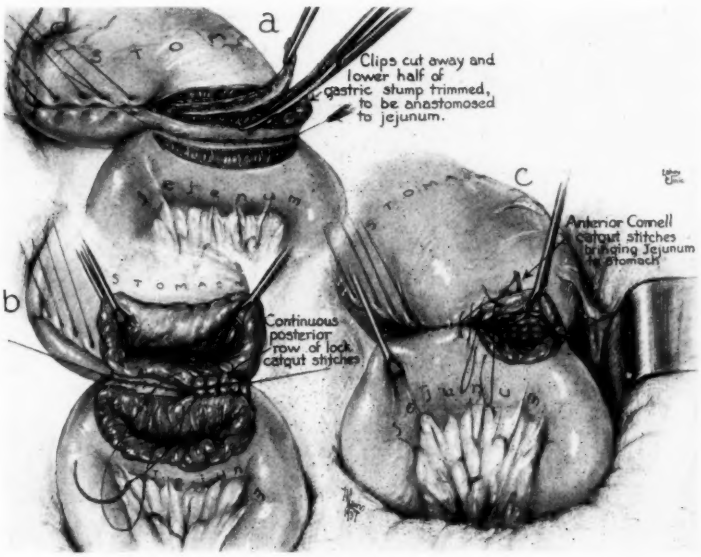
a
Clips cut away and lower half of gastric stump trimmed, to be anastomosed to jejunum.
b
Continuous posterior row of lock catgut stitches
C
Anterior Connell catgut stitches bringing Jejunum to stomach

Fig. 12

clamp is applied, inserting as it does, as shown in the main illustration, two rows of non-absorbable metal clips between which one may burn with the actual cautery to transect the stomach. Note that the stump of stomach is held by Babcock forceps so that it does not retract into the left hypochondrium.

For purposes of illustration, no gauze is wrapped around that portion of the stomach which is to be removed, but in the actual operation a protecting strip of gauze is wrapped around the Ochsner clamp at its pyloric portion.

Note also that the wound edges are protected by the cellophane pads which we employ and have described, a single strip of cellophane being placed between two layers of gauze about 18 inches square. The edges of the gauze are hemmed by the nurses, autoclaved, and before using, soaked in salt solution. Upon wetting these pads they become soft and pliable, and cling readily to the edge of the wound as they are draped around it to protect the wound. We have used these pads now for some years and feel certain that they play a considerable part in protecting wound edges from contamination.

Fig. 12. The upper half of the gastric stump which has been closed by the clips in the von Petz sewing machine is closed first by a continuous row of catgut sutures, then by inverting this row of sutures with another layer of continuous Cushing's catgut sutures, and finally by an interrupted layer of mattress silk sutures as shown in a.

The ligament of Treitz, not shown in this illustration, is now located and a long loop of the jejunum brought up over the transverse colon to be approximated to the lower half of the transected stomach. As is shown in a, this loop of the jejunum is attached to the posterior wall of the stomach by a layer of interrupted black silk sutures. The jejunum is incised through all of its coats for a distance to correspond to that portion of the stomach which is to be anastomosed to it.

After this procedure a small opening is then made with scissors in the lower portion of the stomach of sufficient size to admit only a suction tube into the gastric stump. With this suction tube, before any larger opening is made, the gastric stump is sucked thoroughly dry of its content. When the stump is thoroughly dry that portion of the stomach containing the clips is cut away for the entire distance which is to be anastomosed to the jejunum. As shown in b, a second layer of a continuous posterior row of locked catgut stitches is applied between the stomach and the jejunum. The posterior layer of continuous locked stitches is continued in c, as an in, out, and over Connell suture in order to complete the inner row of anastomotic sutures.

We feel sure that it is not necessary to get out all of the metal brads as we have repeatedly made this anastomosis over metal brads left in the cut edge of the stomach and have never seen any bad results from it.

in the management of the active stage of the ulcer before coming to surgery is more necessary than in this one. Certainly there is no operation in surgery in our experience in which the type of anesthesia plays a greater part not only in relation to the ease with which the operation can be done but more particularly to complications, such as pulmonary complications, wound infections, and obstruction after operation.

We have passed through several phases of the employment of different types of anesthesia. Our first operations were done under ether and it soon became evident that this type of anesthesia was not desirable due to the length of time necessary to

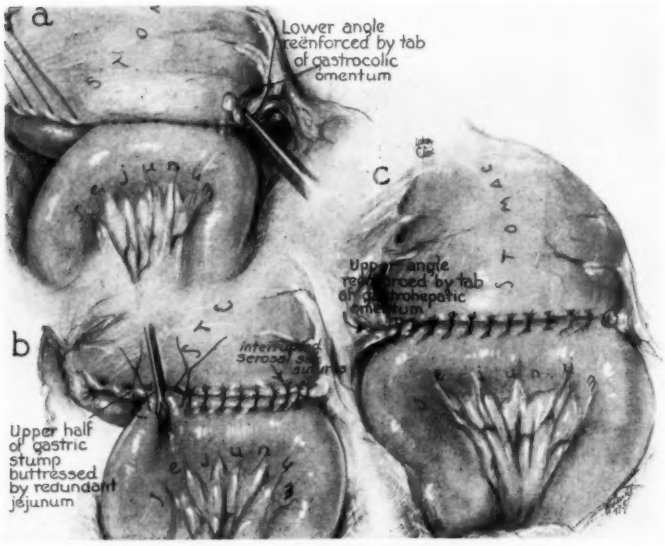

Fig. 13

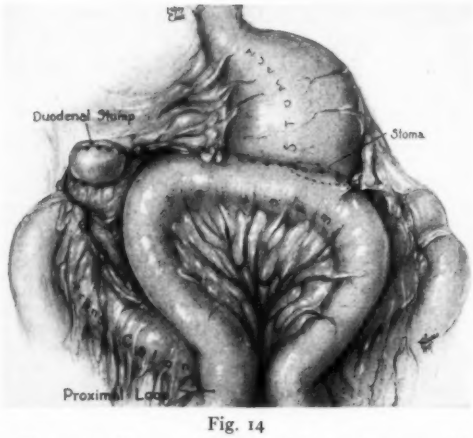

Fig. 14

Fig. 13. a, The completed Connell catgut suture with the upper end of the stomach closed. In b, the anterior row of catgut sutures is covered by a row of interrupted black silk sutures. Note the method in b of buttressing the jejunum over the upper closed half of the stomach by placing silk stitches between the posterior and anterior wall of the stomach and the jejunum, thus securely reinforcing this suture line with the buttressed jejunum.

In c the complete anastomosis is seen; the lower half is occupied by the anastomosis, the upper half of the stomach serving to buttress the excess jejunum over the closed upper half of the transected stomach. Note also that as the last stitch on the lesser curvature is tied, a tab of gastrohepatic omentum is tied in it to reinforce the angle and to suspend the suture line, and in the lower angle likewise a tab of gastrocolic omentum is tied into the last lower stitch to reinforce this angle. This may also be seen in the lower angle in a. This we believe has been a valuable procedure in suspending the line of anastomosis and in reinforcing the upper and lower angles.

Fig. 14. This shows the Hofmeister anastomosis completed. In it may be seen the closed duodenal stump, the jejunum buttressed over the upper half of the stomach, the gastrohepatic omentum tied into the upper angle, and the gastrocolic omentum tied into the lower angle of the anastomosis.

One of the purposes in presenting this illustration is to mention particularly the length of the jejunal loop necessary to approximate it to the transected end of the stomach without tension. One must realize, when the length of jejunum required is estimated, that when the anastomosis between the jejunum and the stomach is made the stomach is under tension, pulled as it is down into the wound. One must also realize that after the anastomosis is made the stomach will retract into the left hypochondrium and that if a short length of jejunum is brought up over the transverse colon to anastomose to the cut end of the stomach, when that structure retracts, the suture line may be under considerable tension. It is, therefore, very important, we believe, to pull out plenty of jejunum and then to pull out quite a little more, allowing for this retraction of the stomach into the left hypochondrium. We have seen no disadvantage in the long jejunal loop. Here the proximal loop of the jejunum is shown anastomosed to the lesser curvature of the stomach as is so frequently our custom. Note also that no jejunojejunostomy is employed.

complete many of these complicated procedures, and due to the fact that undesirable depths of anesthesia were necessary in order to obtain relaxation sufficiently adequate to get the exposure

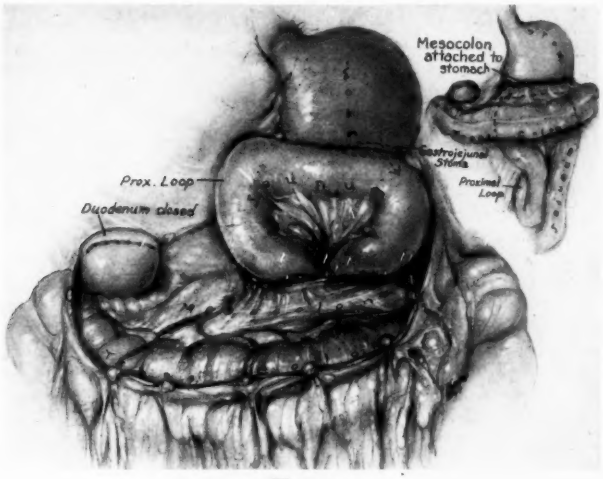

Fig. 15

Fig. 15. Although we now prefer antecolic anastomoses of the jejunum to the cut end of the stomach, there will be cases occasionally in which, because of a short jejunal mesentery or a very thick, fat omentum, it will not be feasible to make satisfactory antecolic anastomoses. For that reason this illustration is shown depicting the method of making posterior anastomoses, and, as shown in the insert in the right upper corner, the method of attaching the cuff of the mesocolon to the stomach above the line of anastomosis to make the anastomosis within the greater peritoneal cavity. In our experience there will be cases occasionally in which it will be almost impossible to accomplish this attachment of the mesocolon to the stomach above the line of anastomosis.

Fig. 16. The method of resection by exclusion according to Finsterer. This has proved a very useful procedure for us in patients in whom the ulcer was so close to the common bile duct that it did not seem feasible to undertake its removal. It has likewise proved valuable in bad risk patients in whom it did not seem feasible to spend the time necessary for the dissection of an indurated, adherent ulcer on the posterior wall. Note that the stomach has been cut off proximal to the pylorus and turned in; a subtotal gastrectomy will then be done up to the level shown by the dotted line. We have employed this procedure in 19 cases. It has been quite satisfactory. In 15 such patients followed the end-results have been just as satisfactory as those in whom the ulcer had been removed. One must not employ this procedure unless it is certain that there is no pyloric obstruction. Unless there is free drainage through the pylorus, fluid will accumulate in the small gastric stump and rupture the sutured end of the distal gastric stump. Failure to realize the presence of a sufficient degree of pyloric obstruction to interfere with drainage brought about the only fatality which we have had in the 19 patients in which the Finsterer resection by exclusion was applied.

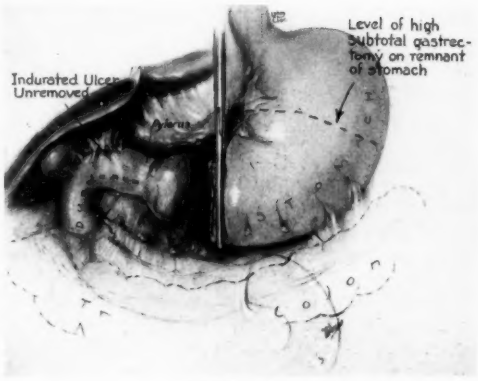

Fig. 16

with which to do high gastric resections. Following the abandonment of ether we employed spinal anesthesia in the form of spinocaine. The disadvantage of this anesthesia was its inadequate time length. Often these patients under spinocaine would come out of their anesthesia at the end of an hour to an hour and a quarter, at the latest, an hour and a half. This was particularly undesirable since at this time many of the patients frequently had marked drops in blood pressure. In spite of this, it was still necessary to administer a general anesthesia and carry these patients into considerable depths in order to maintain the relaxation necessary to do high sutures in the extensive resections. This combination of anesthesias, therefore, was soon given up and we turned to intratracheal ethylene combined with regional anesthesia and splanchnic block. This

proved to be a very satisfactory anesthesia. Many subtotal and some total gastrectomies were done under this form of anesthesia. While intratracheal ethylene alone did not provide sufficient relaxation for the comfortable performance of high subtotal gastrectomy, quite adequate relaxation was obtained when a regional infiltration with novocain was added; and when to this was added novocain splanchnic block, greater relaxation and less drop in blood pressure were secured.

It was not, however, until the advent of dilute nupercaine solutions, as advocated by Howard Jones, of London, that a really satisfactory anesthesia was obtained for subtotal gastrectomy. We have now employed dilute nupercaine spinal anesthesia in a 1:1,500 dilution for about 3 years in high upper abdominal operations with complete satisfaction and it appears to be the nearly ideal anesthetic particularly for subtotal gastrectomy. With dilute nupercaine spinal anesthesia, complete relaxation now can be obtained up to 3 or 3½ hours and even longer. There have been no undesirable complications with this type of anesthesia, and it is the opinion of our anesthetists that the drops in blood pressure are even less with nupercaine anesthesia than with the other types of spinal anesthetics, pontocaine and novocain. For those who have had earlier experience with nupercaine in spinal anesthesia it is but fair to state that the early use of nupercaine anesthesia in concentrated solutions had associated with it many serious complications which have been overcome by the employment of the dilute solutions.

Before presenting the description of our technical procedures in subtotal gastrectomy we wish to say a few words regarding other types of operation for subtotal gastrectomy. We have occasionally employed the Billroth I type of subtotal gastrectomy. In our opinion, however, it has no place in the radical surgical management of peptic ulcer. Due to the fact that the duodenum in duodenal ulcers, which will represent the majority of the ulcers, or 9 to 1, with which we have to deal surgically, is usually indurated and scarred as a result of the ulcer, this structure is not well adapted under these conditions for anastomosis to the cut end of the stomach. Due to the fact also that one is always interested in being able to bring the stomach over so that it can be anastomosed directly to the open end of the duodenum, there will be the constant tendency to leave sufficient stomach so that this can be done, while the reverse should be true. If one is to accomplish the highest degree of relief for patients with intractable ulcer, then extensive resections of the stomach must be undertaken and there must be no hesitation or uncertainty about the amount of stomach to be removed.

Early in our experience a few of these patients were managed by the Billroth II plan of procedure. This operation is likewise open to the same criticism due to the fact, as with the Billroth I, there is the tendency to leave sufficient stomach so that the ends can be turned in and a gastro-enterostomy established between the two. Both of these operative procedures have been entirely given up in this clinic for several years.

Many of our early subtotal gastrectomies were done by the so called Pólya method, frequently spoken of in the literature as the Reichel-Pólya operation. This operation has been quite satisfactory but has been supplanted for some years in our hands by the Hofmeister operation in which the upper half of the stomach is closed, as shown in Figure 2, and the jejunum anastomosed to the lower half of the cut end of the stomach. This has, as will be discussed, the advantage of a shorter suture line and less danger of leakage.

In the beginning of our experience with subtotal gastrectomy the anastomosis between the cut end of the stomach and the jejunum was made with the jejunum behind the transverse colon as a posterior anastomosis. This necessitates the suture of the mesentery of the colon about the stump of the stomach in order to make the anastomosis between the end of the stomach and the jejunum rest in the greater peritoneal cavity. When subtotal gastrectomy is sufficiently high so that an adequate amount of stomach is removed, it is impossible in many cases to suture the rent in the mesentery about the stomach satisfactorily and without angulation of the colon. For that reason one of us (F.H.L.) designed and published[1] a method of posterior anastomosis whereby the proximal loop of the jejunum was transplanted above the mesocolon with but one loop of the jejunum passing through the rent in the mesocolon, thus cutting down the danger of obstruction to the proximal or distal loop. For the past few years posterior anastomoses have largely been given up and, as will be shown in the operative illustrations, practically all anastomoses between the cut end of the stomach and the jejunum are now made antecolic in location. This has distinctly lessened the incidence after operation of obstruction to the loops of the jejunum going to the stomach.

Early in our experience when the jejunum was brought over the transverse colon in the antecolic

[1]Lahey, F. H. A method of dealing with the proximal loop in posterior Pólya anastomosis. Surg., Gynec. & Obst., 1933, 57:227–230.

position and had been anastomosed to the cut end of the stomach, entero-enterostomy was done between the loops. This additional step to the operation was employed because it was feared that obstruction might occur at the point of anastomosis of the jejunum to the stomach. That has been given up entirely for some years and antecolic anastomoses with long loops of the jejunum are done with no entero-enterostomy. The reasons for this are: (1) that it has been definitely proved to us that entero-enterostomy is not necessary and is even undesirable. If the purpose of subtotal gastrectomy is to remove the largest amount of acid-bearing glands and to cause to flow into the stomach the alkaline upper jejunal contents for neutralization of any remaining acidity, then the addition of an entero-enterostomy to a subtotal gastrectomy with antecolic anastomosis will sidetrack the alkaline jejunal contents into the jejunum, when it would be more desirable for these alkaline contents to flow into the stomach and there further neutralize acidity.

In the beginning of our experience with subtotal gastrectomy the operative procedure was conducted with clamps upon the stomach to prevent soiling. For a number of years now all subtotal gastrectomies have been done with no clamps whatever. When one attempts to apply clamps well up under the left costal margin, the application of these clamps will of necessity limit the height to which the resection can be done; and, if the clamps are applied and the stomach then cut off, because of its high location, there will not infrequently be slipping of the clamps and spilling of the contents. Based upon our experience with these cases, we do not believe that it is possible to do adequately high subtotal gastrectomies, as shown in the roentgenograms of patients who have had subtotal gastrectomies (Fig. 1), unless these operations are done without clamps or with a special procedure done with special clamps as for instance the Shumaker clamps.

The accompanying illustrations with their legends so graphically illustrate the technique of the operative procedure that additional description is unnecessary.

It is our opinion that an operation of this magnitude, should not be discussed without presenting the mortality rate which has occurred in a series of cases. Up to September 28, 1938, 200 subtotal gastrectomies for ulcer have been done. Up to 2½ years ago the mortality was 18 per cent, by far too high. From 2½ to 1½ years ago, the mortality dropped to 11 per cent which was still too high. For the last year and a half the mortality has been zero. We have now done radical subtotal gastrectomy upon 51 consecutive patients without a single death. That these are not selected cases is evidenced by the fact that out of 3,500 ulcer patients treated in the clinic, only 8 per cent of the patients with duodenal ulcers and 23 per cent of the patients with gastric ulcers were submitted to surgery. In order that there may be no misunderstanding about these figures, every one of these patients had been submitted to prolonged medical treatment which failed to relieve symptoms; all of the ulcers were posterior wall-eroding ulcers, and included in these 51 cases were 8 gastrojejunal ulcers which necessitated resection of the jejunum as well as the stomach, and 1 gastrojejunocolic fistula which involved not only resection of the stomach and the jejunum but also resection of the terminal ileum, ascending colon, and right half of the transverse colon.

TREATMENT OF FRACTURES OF THE PELVIS

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FRACTURES of the pelvis are commonly regarded as very serious injuries, and rightly so, because the pelvis is an elastic ring of heavy bone and when a person is subjected to sufficient force to cause a fracture of the pelvis, that force is also apt to cause other injuries which may be serious or even fatal. However, in the majority of instances the fracture itself is not dangerous to life, or even a cause of permanent disability, and it is the injuries to the pelvic viscera or the accompanying injuries to other parts of the body which have given the pelvic fractures a bad reputation.

Likewise, it is generally believed that the treatment of fractures of the pelvis is a very complicated procedure which demands considerable mechanical ingenuity on the part of the surgeon and great fortitude on the part of the patient. And this belief is supported by recent articles on the subject (Jahass, Carruthers, Stern, Langan, Jones, Noland and Conwell, McBride, Leadbetter, Koster and Kasman, and Conway) and even by a rather cursory perusal of recent textbooks on fractures (Key and Conwell). More careful study will reveal that the elaborate pieces of apparatus and apparently difficult procedures illustrated in the literature are used only in certain unusual fractures of the pelvis in which the fragments have been displaced in such a manner that good surgery demands that an attempt should be made to improve their position before they be permitted to unite. And one is very apt to forget that the great majority of fractures of the pelvis are simple fractures without sufficient displacement of the fragments to warrant interference, and that those fractures require no specific treatment.

During the past 6 years 184 patients suffering from fractures of the pelvis were admitted to the Saint Louis City Hospital, and it is interesting to note that 78 per cent of these patients were injured in automobile accidents and that during the past 2 years there has been a rather marked increase in the number of such fractures. The number in each year is as follows: 1932, 27 cases; 1933, 18; 1934, 21; 1935, 22; 1936, 38; and 1937, 58. During this period we have had occasion to try various forms of treatment and have gradually simplified our procedures until we now believe that our pelvic fractures are treated adequately, but are not overtreated, and the principal reason for writing this paper is to emphasize the fact that the great majority of fractures of the pelvis do not require any specific treatment of the fracture and are more comfortable and in general do better if they are simply put to bed and given good nursing care and symptomatic treatment.

In the past we have immobilized our pelvic fractures in double plaster-of-paris spica casts These were abandoned for various forms of swathes and belts, of which perhaps the high water mark was a belt made of a split section of an inner tube from an automobile tire which was provided with laces and enabled us to obtain any desired amount of elastic compression. In addition to the swathes and belts, we have used various forms of slings suspended by ropes and counterbalanced by weights equal to about half of the weight of the patient. These were equipped with spreaders, the spreader being wide where little lateral pressure was desired and narrow or absent when lateral pressure was indicated. We have also combined the above with various types of traction on one or both extremities.

As our experience with these fractures has broadened we have gradually abandoned all forms of active treatment which had no specific purpose. The methods which we now use will be discussed later, and the reasons will be given for employing them.

When confronted by a severely injured patient, the first concern of the physician is the patient's general condition. If he is in a state of profound shock, efforts are made to combat this without subjecting him to a physical and x-ray examination. If a fracture of the pelvis is suspected, an x-ray of the pelvis is indicated because by no other means can one learn the details of the fracture. If the pelvis is fractured it is important to learn whether or not the genito-urinary tract has been injured, because ruptures of the urethra or bladder, if present, demand immediate treatment. Consequently, the urine (obtained by catheterization if necessary) should be examined as soon as possible. If clear urine is obtained lesions of the genito-urinary tract can be ruled out, but if the

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urine contains blood or if blood is present in the urethra or bladder a genito-urinary lesion is present and should be treated immediately.

A discussion of the treatment of fractures of the pelvis should consist of two parts: (1) treatment of the complications of fractures of the pelvis; and (2) treatment of the fracture itself.

1. *Complications of fractures of the pelvis.* Due to the fact that most fractures of the pelvis are due to violence which involves much or all of the body, these fractures are often complicated by other injuries which are frequently more important than the pelvic lesion and usually demand immediate treatment, while the pelvic fracture can wait until the complications are taken care of. It is beyond the scope of this paper to discuss the treatment of the various complications, but the more important will be mentioned.

Probably the most important and a rather frequent complication is surgical shock, and this was the most frequent cause of death in our series in which the mortality was 7.8 per cent. The degree of shock varies greatly and when severe demands immediate treatment. There are many fractures of the pelvis which occur in persons who are killed outright by falls from a height, crushing injuries or automobile accidents which are never diagnosed. The same is true of patients who die soon after admission to the hospital.

In patients with fractures of the pelvis the shock, if present in sufficient degree to cause concern, should receive immediate attention and the fracture of the pelvis may be ignored for the time being. After the patient's general condition has improved sufficiently to warrant interference, visceral lesions and any accompanying fractures of other bones which may be present are treated.

The most frequent visceral lesions are those of the genito-urinary tract. These occurred in 23, 12 per cent, of our patients and were diagnosed as follows: Lacerations of the urethra, 3; perforation of the bladder, 4; contusion of the bladder, 5; and genito-urinary lesions of an undetermined nature, 11. This last group showed gross blood in the urine which cleared up after a few days. The mortality is higher in the patients with genito-urinary lesions (22 per cent in our 23 patients as compared with 7.8 per cent in the entire series of 184 fractures of the pelvis).

A rather important and relatively frequent complication of fractures of the pelvis is fracture of other bones. These are particularly frequent in those due to automobile accidents. When other fractures are present, treatment of these should be begun as soon as the patient's general condition permits and carried out along standard principles with due regard to the fact that the patient must remain recumbent while the pelvic fractures are uniting.

Rare complications are injuries of the rectum, thrombosis of large veins, and injuries of the large nerves. In our series there were no injuries of the rectum or of the great vessels and there was only one nerve injury of sufficient importance to be recognized. This last was an incomplete lesion of the sciatic nerve in which the paralysis cleared up spontaneously in a few weeks. This is in sharp contrast to the findings of Lam, who stated that 9 per cent of pelvic fractures were complicated by nerve lesions. We agree with Wakely's opinion that the large size of the foramina of exit in proportion to the size of the nerves is probably responsible for the fact that the nerves are rarely injured at the time of the original injury or encroached upon by callus during the period of healing.

2. *Treatment of the fracture itself.* From the standpoint of treatment, fractures of the pelvis may be divided into two groups: (1) Those in which the position of the fragments is satisfactory; and (2) those in which the position of the fragments is not satisfactory.

In the first group the patients are kept in bed and no specific treatment is indicated. In the second group specific mechanical force is so directed that it will tend to correct definite deformities and to maintain the correction until the fractures have united sufficiently to prevent a recurrence of the deformity. It is thus evident that a fairly accurate diagnosis of the condition of the pelvis is desirable before treatment is instituted and this is best obtained by the x-ray, because, while certain gross deformities may be detected by inspection or palpation, the details of the fracture remain obscure. Consequently, we advise an anteroposterior roentgenogram of the pelvis before deciding on the method of treatment. From this x-ray the given case can immediately be placed in one of the two groups already mentioned.

Gross displacement of large fragments which result in asymmetry of the pelvis demand correction if possible, but minor displacements are not considered to be of sufficient importance to demand specific treatment unless they involve the hip or sacro-iliac joint or symphysis pubis or encroach upon the birth canal in a female patient.

It is to be noted that the classification given does not take into consideration the location, extent, or number of fractures present in the pelvis. As a matter of fact, the majority of fractures of the pelvis are multiple (70 per cent in our series);

Fig. 1. Left, Malgaigne type of fracture showing hemisubluxation of the pelvis. Right, Roentgenogram of same patient taken after reduction of the fracture by means of traction in a Hodgen splint.

yet, approximately 75 per cent of all pelvic fractures fall into group 1 and require no reduction and no immobilization other than rest in bed. These include not only isolated fractures of the pelvis in which the ring of the pelvis is not broken, such as fractures of the wing of the ilium and fractures of a single ramus of the pubis or ischium, but also fractures of both rami or the body of the pubis in which the pelvic ring is broken, but in which there is no marked displacement of the fragments. It also includes certain double fractures of the pelvic ring, such as the fractures of both rami on each side of the body of the pubis without displacement of the central fragment and occasional fractures of the Malgaigne type with a complete fracture through the anterior portion of the ring and another fracture through the posterior portion in the vicinity of, and roughly parallel to, the sacro-iliac joint in which the fragments are not displaced.

Why do these fractures require neither reduction nor immobilization? They require no reduction because the fragments are not sufficiently displaced to interfere with union or with function after union occurs. They require no specific immobilization because the displacement, when it occurs in pelvic fractures, is usually due to the fracturing force rather than to muscle pull and not only has this force ceased to act, but by the time the roentgenogram has been taken the patient has been moved to the hospital and subjected to more strain than will result from lying in bed until the fragments have united. Consequently, bed rest is all that is needed in the way of treatment of the fracture, but during the first week or so the pelvis may be quite sore and movements may be very painful. In order to avoid the necessity of lifting or turning the patient, he is placed on a fracture bed during this period. Such a bed is fitted with cross straps over the mattress which may be tightened while the mattress is lowered for the use of the bed pan and general nursing care. A pillow is placed under each knee to maintain the lower extremities in a position of moderate flexion. A frame is placed on the bed and a horizontal bar is suspended above and within reach of the patient in order that he may lift his body with his hands and shift his position in bed at will. If the patient is not comfortable, traction of from 5 to 10 pounds is placed on each leg. Skin traction by adhesive is sufficient and the rope passes over pulleys at the foot of the bed. In certain instances a strip of adhesive about 6 inches wide is placed around the pelvis, but we do not use the adhesive or any other form of binder as frequently or for as long a period as we have in the past, because we find that our patients do just as well and are more comfortable without them.

As soon as the fracture is sufficiently healed to permit the patient to use a bed pan without pain (about 2 weeks) he can be moved to an ordinary hospital bed which may have a fracture board placed between the spring and the mattress to prevent sagging. This also should be fitted with a horizontal bar to enable him to move about in bed at will. The patient may be propped up in bed or sit up at will. It is thus evident that the treatment is largely symptomatic and it is believed that the movements or positions which do

Fig. 2. Left, Fracture of the acetabulum with partial intrapelvic luxation of the fragments. Right, Same after reduction by traction in a Hodgen splint and manipulation without anesthesia.

not cause undue pain will not cause displacement of the fragments or interfere with the healing of the fractures.

Depending upon the location, extent, and severity of the fractures, the patient is kept in bed for from 4 to 8 weeks. At the end of this time he is gotten up on crutches and begins to walk with support. In a week or 2 the crutches are discarded and a cane is used until the patient walks comfortably without it.

In fractures in which the fragments are sufficiently displaced to interfere with function, an effort should be made to reduce the displacement and to maintain the reduction. The methods used are traction, lateral pressure or, rarely, manipulation under general or spinal anesthesia.

The types of fractures which require especial attention are: (1) Separations at the symphysis or fractures through the anterior ring with spreading or rotation of the ilia; (2) double fractures of the rami on each side with displacement of the middle fragment; (3) the double vertical fractures of Malgaigne with displacement of the lateral fragment; and (4) fractures of the acetabulum.

In separation of the symphysis or fractures through the anterior ring, displacement may occur by rotation of one innominate bone so that its anterior portion is displaced upward and outward or the pelvis may be opened almost directly outward in a manner similar to that in which a clam shell is opened. In these fractures lateral compression of the pelvis is desirable in order to push the two sides of the pelvis together, and also to so rotate the displaced lateral fragment that it will approach its normal position. We have found that adhesive strapping and swathes cannot be depended upon to accomplish the desired result. In order to obtain continuous lateral pressure on the pelvis the patient is placed in a canvas sling or hammock which passes under the pelvis transversely and the ends of which are suspended by weights equal to about one-third of the weight of the patient. The ends of the hammock are close to the midline of the body and it exerts considerable lateral pressure. If it is desired to decrease the amount of lateral pressure, a wooden spreader is placed between the free ends of the sling and the amount of lateral pressure exerted by the sling varies inversely with the width of the spreader (Key and Conwell). At the same time we put traction on one or both legs. If the symphysis is rotated upward on one side, we place more traction on that extremity.

In double fractures through the anterior ring with displacement of the central or pubic fragment we place the patient in a sling for a short time with traction on both lower extremities, which are maintained in a position of moderate abduction and extension in an effort to pull the displaced fragment down to its normal position.

In the double vertical fractures of the Malgaigne type in which there is a fracture through the anterior ring and another fracture through or near the sacro-iliac joint there may be a variable amount of displacement of the large lateral fragment which carries the lower extremity with it so that this extremity is actually shortened in its relation to its fellow while its length as measured

Fig. 3. Central fracture of acetabulum with intrapelvic luxation of the head of the femur.

from the anterior superior spine of the ilium is not altered. The loose lateral fragment may also be rotated or everted.

The upward displacement is probably caused by the fracturing force, but the muscles which pass upward from the loose lateral fragment to the lumbar spine and lower ribs tend to maintain the displacement and may be a factor in causing it. At any rate, the treatment indicated is to pull the loose fragment down to approximately its normal position and to hold it down until union is sufficiently firm to prevent recurrence of the deformity. This can be done by making relatively strong traction on the extremity on the affected side. This has been done by means of a well-leg traction splint, but our usual procedure is to place the leg in a Hodgen's splint and pull the extremity downward just as though the

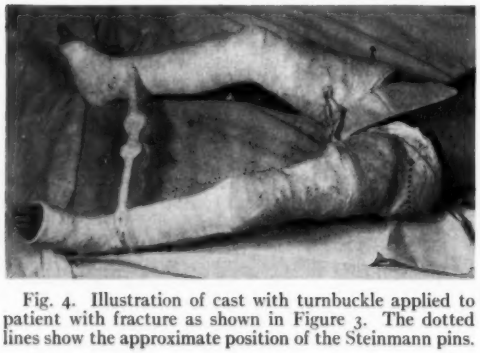

Fig. 4. Illustration of cast with turnbuckle applied to patient with fracture as shown in Figure 3. The dotted lines show the approximate position of the Steinmann pins.

Fig. 5. Final result after treatment in cast. (Same case as in Figure 3.)

patient had a trochanteric fracture of the femur (Fig. 1). If there is no improvement in the position as shown by the x-ray picture taken at the end of 48 hours of strong traction, it is probable that the fragments are locked in their abnormal relationship and an attempt should be made to manipulate the fragment downward under a general anesthetic while the traction is maintained.

If there is also rotation or eversion of the lateral fragment, it is probable that this will be corrected as the upward displacement is corrected by the traction. However, if the x-ray film, which should be taken about 48 hours after the application of the traction, shows that there is persistent rotation or eversion of the lateral fragment, it is evident that lateral pressure on the pelvis is indicated and the patient should be placed in a pelvic sling, as noted in the preceding paragraphs, while the downward traction on the extremity is maintained.

Watson Jones has recently published a method by which these fractures are reduced by placing the patient on a pelvic rest in the lateral position. A double plaster-of-paris spica is then applied and the patient is maintained in the lateral position in the cast until the fractures have healed. We have not used Jones' method, but have obtained satisfactory reduction and healing in our cases by the method described here. The traction is maintained for from 4 to 6 weeks and then after 2 weeks further rest in bed the patient is gotten up on crutches which are discarded as soon as he is strong enough to do without them.

The fractures of the acetabulum fall into three groups: (1) simple fractures of the acetabulum

Fig. 6. Left, Fracture of the anterior rim of the acetabulum. Right, Result after open reduction.

without displacement; (2) central dislocations at the hip; and (3) fractures of the rim of the acetabulum with or without dislocation at the hip. We believe that joint fractures usually do better if treated in traction, even when there is no appreciable displacement of the fragments. Consequently, these fractures are treated by traction for from 2 to 8 weeks, the period of traction varying directly with the severity of the fracture. If the head is not displaced inward the patient is simply put to bed and about 10 pounds of traction is applied by Buck's extension or the extremity is suspended in a Hodgen's splint which, in the case of an adult, affords from 10 to 20 pounds of traction in a position of slight flexion and moderate abduction. The amount of traction increases as the suspending rope is inclined away from the vertical position.

In the central dislocations at the hip the head of the femur is driven inward fracturing the floor of the acetabulum and pushing the fragments before it into the pelvis. If this fracture is permitted to heal with the head in its abnormal position, a stiff and painful hip is obtained. Consequently, the head should be brought out to its normal position. Usually the displacement of the head is not marked, and a moderate amount of traction (15 to 20 pounds) with the extremity in slight flexion and abduction is sufficient to reduce the dislocation and as the dislocation is reduced the fragments of the floor of the acetabulum tend to follow it and fall back into their normal positions (Fig. 2).

It is to be noted that we do not advocate placing the finger in the rectum and attempting to push the fragments of the floor of the acetabulum outward into their normal position, as is advocated by Boehler. This is because we fear that a sharp fragment might be pushed through the wall of the rectum and cause an infection, and also because we have found it not to be necessary if one will only apply traction and wait a few days after the dislocation is reduced before deciding on the—to us—rather dangerous procedure.

Occasionally the head is driven far into the pelvis and locked there by fragments or margins of the defect which encroach upon the narrow neck behind the relatively large head and traction in line with the shaft of the femur will not dislodge it. In such instances we try to pull the head out by manual traction in bed without an anesthetic. If this is not successful the patient is given a general anesthetic and traction is made in line with the shaft of the femur with the extremity in a position of slight abduction, and also traction is made directly outward on the upper thigh; thus, the resultant of the two forces is a pull outward and downward roughly in line with the neck of the femur. Occasionally, in resistant cases, we have manipulated the extremity into abduction or adduction while the traction was maintained.

We have seen only one patient in whom it was not possible by manipulation alone to dislodge the head from the pelvis. This was quite an old man with a marked displacement, as illustrated in Figure 3. In this particular instance metal pins were placed through the trochanteric region of each femur passing from before backward and incorporated in plaster-of-paris casts. The casts extended to the toes where the two feet were fastened together and a turnbuckle was placed between the legs in the region of the upper thigh.

As the turnbuckle was spread the trochanters were pulled apart and thus the head of the femur was gradually pulled out of the pelvis into its normal position (Figs. 4 and 5). Unfortunately, this patient died of pneumonia about a month later.

In all, there were 15 patients with fracture of the acetabulum and central dislocation at the hip in this series who were treated by the methods here described. It has been possible for us to trace 6 of these and all of them except one returned to their original occupations without appreciable disability. The exception walked with a slight limp, had moderate limitation of movement at the hip, and complained of some pain, but was able to do her housework and climb stairs without difficulty.

The third group of fractures of the acetabulum comprises those cases in which a significant fragment of the rim is broken off and displaced. There was only one such fracture in our series and in this instance the hip was not dislocated. In our case the loose fragment was exposed through an anterior incision and, after reduction, was fixed with chromic catgut sutures and the hip was immobilized in a plaster-of-paris spica cast for 6 weeks. An apparently normal hip was obtained (Fig. 6). Where this fracture complicates a dislocation at the hip the dislocation should be reduced and then, if the fragment is not in a satisfactory position, it should be replaced and fixed by open operation.

CONCLUSIONS

In a series of 184 consecutive fractures of the pelvis we have found that 70 per cent were multiple fractures and also that over 75 per cent were simple fractures without important displacement of the fragments.

With simple fractures without important displacement, whether they be multiple or single fractures, the patients appear to be more comfortable, recover more rapidly, and obtain satisfactory results if they are treated by permitting them to lie in bed in a comfortable position until the sensitiveness disappears, after which time they may move about in bed at will.

In fractures with important displacement of the fragments an attempt should be made to obtain a good functional reduction.

In pelvic fractures with complications, the complications usually demand immediate treatment and the fracture of the pelvis may be allowed to wait until the complications are taken care of.

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AUTOPLASTIC FASCIA SUTURES IN REPAIR OF INGUINAL HERNIA

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IN 1904 McArthur reported a series of cases of inguinal hernia repair, using aponeurosis of external oblique as suture material. Supported by experimental work, he maintained that the method of closure was not as important as the suture material. These sutures, one obtained from each free edge of the incised aponeurosis, were fixed medially at the pubis and the midline. The free ends were attached to silk threads, which in turn were threaded through needles. The suture derived from the upper flap was used to unite the conjoined tendon and the internal oblique muscles to Poupart's ligament. The suture from the lower flap united both flaps of the aponeurosis.

In 1916 and 1917 Lewis and his associates, reporting experimental and clinical work, showed conclusively that autotransplants of fascia and tendon would continue to live and that they would retain their own gross and histological characters.

In 1921 Gallie and LeMesurier repeated this work of Lewis, arriving at the same conclusions. They called attention to the fact that there was no evidence of proliferation of the essential cells of the transplanted tissue. They claimed that union or healing occurs not from tendon or fascia cells, but from connective tissue cells and therefore forms a true scar; therefore, the necessity of the removal of all areolar tissue attached to the fascia or tendon sheath. Furthermore, scar tissue has a tendency to stretch. Therefore transplants are to be attached not end to end, but by broad apposition or application of transplant to the surrounding tissue. Gallie and LeMesurier recommended the use of fascia lata. The disadvantage of this method of procedure is that the source of fascia lata is somewhat distant from the site of operation.

This work was followed by others, notably Koontz, who experimented with, and popularized, the use of ox fascia in the repair of inguinal and ventral hernia. Koontz claimed the following advantages of this method: (1) ox fascia can easily be obtained, prepared, preserved in tubes, and kept in stock to be used when needed; (2) although a heteroplastic graft, ox fascia is no different than fascia lata, since it depends for its strength on the collagen fibers which are inert and act as framework for fibroblasts to maturate and form scar tissue. The serious disadvantage of the method, however, is the difficulty of removing all the foreign material from the fascia. This results in atypical postoperative febrile courses, associated often with more or less prolonged drainage from the wounds with or without infection.

The author has modified McArthur's procedure incorporating principles advanced by the authors quoted, to obtain the maximum strength in hernial repair. This method can be adapted to any well recognized operation. For illustrative purposes the author has selected the so called Halsted procedure.

After the usual preparation of skin an inguinal incision is made, exposing the aponeurosis of the external oblique. The upper surface of the aponeurosis is then stripped of its areolar connective tissue and is incised in the direction of its fibers from the edge of its muscular portion down to the middle of the external ring. It is best not to complete the division of the external ring until the next two incisions, parallel to it, are completed. These are made 6 to 7 millimeters above and below, beginning at the muscular edge of the aponeurosis and extending to its insertion medially, the upper into the midline in association with the

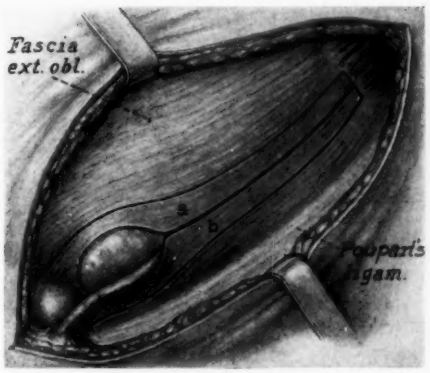

Fig. 1. Formation of autoplastic fascial sutures. *a*, strip derived from the upper flap of the external oblique; *b*, strip derived from the lower flap.

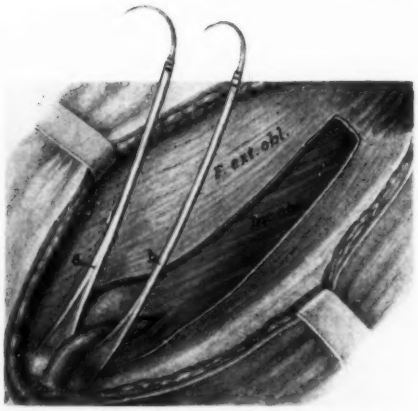

Fig. 2. Fascial sutures attached to needles.

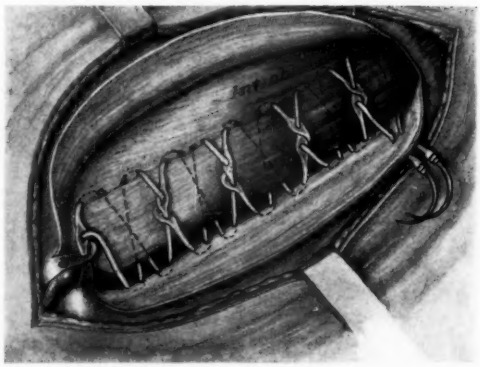

Fig. 3. Diagrammatic representation of the passage of fascial sutures through the internal oblique, the conjoined tendon, and Poupart's ligament, and the mutual transfixion of these sutures.

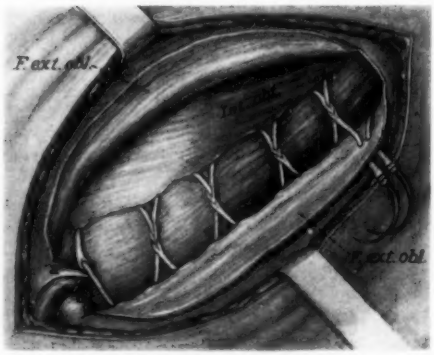

Fig. 4. The fascial sutures approximate the internal oblique and conjoined tendon to Poupart's ligament. The reconstruction of the pillars of the external ring is obvious.

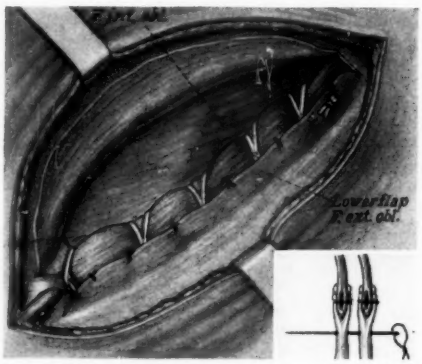

Fig. 5. The overlapping of the lower flap of the aponeurosis is shown.

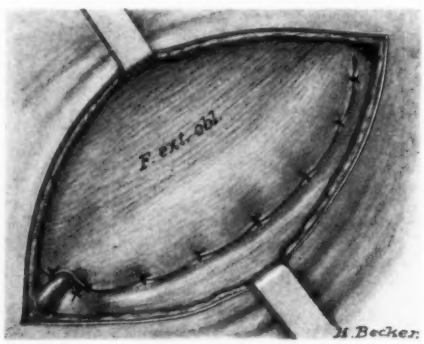

Fig. 6. The overlapping of the upper flap of the aponeurosis over the upper surface of the lower flap is shown

rectus fascia, and the lower into the pubic bone. The strips of fascia (Fig. 1, *a* and *b*) thus patterned are divided at their junction with the muscular portion of the external oblique. They are then stripped from the underlying areolar tissue down to their insertions and are ready to be used (Fig. 2). A transfixion suture is placed through the free end of each strip and the strips are then attached to Ferguson (medium) needles, as indicated in Figure 2, *a* and *b*. The conjoined tendon, internal oblique, and Poupart's are then exposed and freed from areolar tissue. The sac is dealt with in appropriate manner.

The fascial sutures, *a* and *b* are made to transfix each other as shown in Figure 3. The lower fascial suture, *b*, is then passed through the conjoined tendon from its anterior surface toward the poste-

rior and then upward through Poupart's ligament close to the pubic spine, shown in Figure 3. The upper of the fascial sutures, *a*, is passed through Poupart's in a direction opposite to the usual, toward its lower edge. After emerging from the lower edge of Poupart's ligament, it is passed in an anterior direction through the conjoined tendon as shown in Figure 3. The fascial sutures are drawn taut and made to transfix each other. The procedure just described is repeated, the thread, *b*, which has just emerged from Poupart's ligament, always enters the anterior surface of conjoined tendon, goes in a posterior direction, and then again passes through Poupart's ligament in the usual manner. The upper suture, *a*, the one emerging from upper surface of conjoined tendon, enters Poupart's ligament in reverse of the usual manner, then emerges from the lower edge and enters the internal oblique from its posterior aspect to emerge again anteriorly, then transfixes the other suture, *b*, and is in turn transfixed by it (Figs. 3 and 4). The average fascial strand is ample in length to make four complete sutures with ease. At the end both sutures are brought through the lower flap of the external oblique.

The lower flap of aponeurosis is than tacked to the upper surface of the internal oblique and conjoined tendon without tension, by interrupted black silk sutures (Fig. 5). The needles are then cut from the fascial strips. The stumps of the strips sewed to each other are sutured to the upper surface of the lower flap of aponeurosis. The upper flap is then tacked, without tension, to the upper surface of lower flap and to Poupart's ligament with fine black silk sutures, interrupted (Fig. 6). Scarpa's fascia and skin are closed in the usual manner.

This method's claim to existence is that it adds to McArthur's method the principles enunciated by Dean D. Lewis and his associates and Gallie and LeMesurier. The stripping of the overlying and underlying areolar tissue from the aponeurosis is emphasized. The simultaneous use of two sutures passing in opposite direction causes a broad approximation of the surfaces and leads to greater security. The double transfixion of sutures prevents slipping, thereby adding strength. This double transfixion together with the fixation of the sutures at the pubic spine reconstructs the pillars of the external ring, thus causing the latter to fit snugly around the emerging cord without constriction.

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COMPLETE LACERATIONS OF THE PERINEUM

An Analysis of 205 Surgical Repairs

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DESCRIPTIONS of an effective surgical cure still comprise a large part of the literature of complete lacerations of the perineum. Studying the reports, however, one is chiefly impressed by the fact that there is a noticeable lack of agreement as to the technique which gives the best results. So far as we have been able to discover, no large series of cases is on record in which a single method was employed by many individual surgeons. It is with the idea of recording such a series that we are reporting herewith 205 complete lacerations of the perineum treated at Charity Hospital of Louisiana in New Orleans during the 10 year period ending June 20, 1938. The series does not include any acute tears.

ANALYSIS OF DATA

Race and age. Thirty-four of the 205 patients were colored and 171 white, giving a ratio of 1:5. During the same period the ratio of hospital admissions was roughly 4:5, and three-fifths of the number of registered births in this area were white. Our figures, therefore, corroborate the conclusions of C. J. Miller, W. E. Levy, and others, whose comparative studies of white and negro women reveal a relatively small percentage of perineal injury during delivery in negro women. The age range in this series was from 8 to 56 years.

Etiological factors. In 2 patients parturition was not a factor: One complete perineal tear occurred in an 8 year old colored child, following rape, and the other, also in a child, was produced by a fall on a picket fence. About two-thirds (133) of the remaining patients were primiparæ.

Complete perineal lacerations may occur in the practice of even a competent obstetrician, and generalizations are not entirely wise. On the other hand, there is no doubt that they are usually associated with poor obstetrics. An analysis of these cases justifies the statement that a third degree tear is nearly always preventable if competent medical attention is provided. Hospitalization for all primiparæ as well as for all abnormal multiparæ is also highly desirable.

Approximately half (104) of the women in this series were attended by midwives at delivery, a number entirely out of correspondence with the fact that during the same period only 20 per cent of the total number of deliveries in the community were conducted by midwives. Of the 101 cases conducted by physicians, 48, approximately one-half, were operative deliveries, and usually difficult ones. It is significant, under the circumstances, that only 9 of the 205 women, 4 per cent, were delivered in a hospital, where the proper facilities, essential equipment, and trained personnel were available.

The incidence of third degree lacerations among negro women, as we have already pointed out, is very much lower than in white women. There is an even more striking difference in the racial incidence in relation to the mode of delivery. Twenty-six of the negro women, 76 per cent, were delivered by operative methods, against only 22, 13 per cent, of the white women. It is therefore reasonable to assume that when a tear occurs in a colored woman it is usually the result of operative trauma, whereas white women frequently suffer complete perineal tears during natural parturition. Third degree lacerations occurred typically during spontaneous delivery in primiparæ, but usually followed operative intervention in multiparæ.

Previous attempts at repair. Repair had been previously attempted in 47 patients, who had been submitted to a total of 73 operations, ranging in number from one attempt in 14 cases to 6 in 1 case. Eighteen of the repairs were attempted immediately after the injury occurred, and it is a significant fact, from the standpoint of the occurrence of the injury as well as the failure of the attempted repair, that only three of the women had been delivered in hospitals. In 29 cases the previous secondary operation had been successful, but the tear recurred in a subsequent delivery. It is again significant that in only 7 of these 21 cases was the subsequent delivery conducted in a hospital.

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Read before the New Orleans Gynecological and Obstetrical Society, December 16, 1938.

The recurrence of the tear in a future delivery is a disheartening possibility, but one which is by no means inevitable, as our own experience shows. In most instances the damage can be prevented if the proper precautions are taken. The patient should be cared for in hospital, deep episiotomy, sometimes bilateral, should be employed, and the whole delivery should be conducted with extreme care and gentleness. Cesarean section should be seriously considered if the child is large and the perineum is excessively scarred and rigid, or if the patient desires sterilization.

Findings and symptomatology. Although a consideration of the mechanism by which complete tears occur is not part of this report, it must be noted that the results in precipitate deliveries, in difficult natural deliveries, and in badly managed operative deliveries are practically the same. In all the cases in this series the external and internal sphincter ani muscles were completely severed. In most instances the levators were also ruptured or badly stretched, which is an important consideration. If these muscles are undamaged, bowel control is still possible, even when the sphincter ani has been destroyed. In 168 cases, 82 per cent, the anterior rectal wall was torn and required suture, and in 113 cases, 55 per cent, the laceration extended up the bowel wall for a distance of at least 3 centimeters. In other words, in well over half the cases the complete laceration of the perineum was complicated by a serious involvement of the rectal wall, which greatly increased the difficulties of surgical repair. Definite coexistent rectoceles were present in about a third of the cases, which is another important consideration, for failure to recognize and correct a rectocele or an enterocele is often responsible for unsatisfactory surgical results.

The average duration of the injury prior to correction was 6.6 years, and 1 patient had actually allowed it to continue for 41 years. These figures are not surprising in view of the generally low level of intelligence likely to be exhibited by patients who are public charges. Such women will endure for long periods of time conditions which private patients would not tolerate under any circumstances.

The entire group complained of incontinence of feces. All lacked control of liquid stools and gas, though some 25 per cent had partial control of formed stools, especially when a natural tendency to constipation existed, or when a constipating diet had been deliberately chosen. Unsatisfactory sexual relations was often a major complaint, and there was a high incidence of melancholia, unnatural introspection, and pronounced sense of inferiority. Such patients frequently isolate themselves from all social contacts and brood continuously.

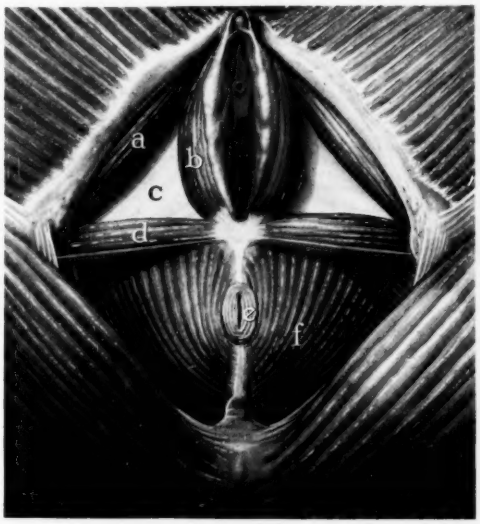

Fig. 1. Anatomy of the pelvic floor. *a*, Ischiocavernosus muscle; *b*, bulbocavernosus muscle; *c*, endopelvic fascia; *d*, transversus perineii muscle (superficial and deep); *e*, sphincter ani muscles (internal and external); *f*, levator ani musculofascial sling. Note the decussation of fibers and the attachment of the sling to the perineal body. It is this anatomical arrangement which permits the sling to exert an effective sphincteric action on the rectum.

SURGICAL REPAIR

The necessity for the surgical correction of complete perineal repairs need not be discussed. There is no other method of treatment because there is no tendency in such cases toward spontaneous healing. Surgery, furthermore, should not be unduly delayed, because the constant irritation produced by the unhygienic condition of the tissues aggravates the original lesion. Another consideration, which is rarely emphasized, is that perineal lacerations tend to be aggravated by the natural changes of advancing age. Several of the patients in this series contributed the unsolicited information that their symptoms had become more troublesome during the time of the menopause period.

The therapy of complete perineal lacerations falls naturally into three separate divisions, preoperative treatment, operative technique, and postoperative care, and all are of the utmost importance.

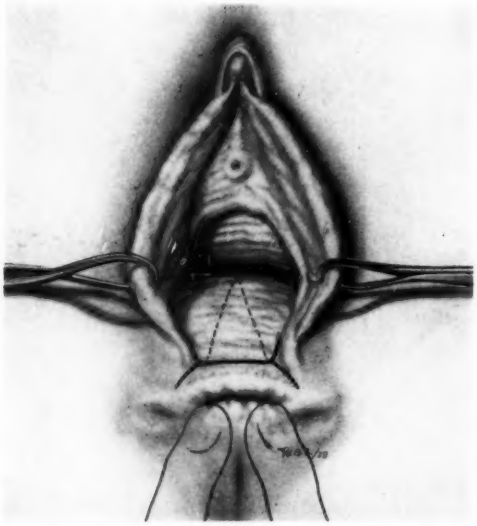

Fig. 2. Complete laceration of the perineum, without involvement of the rectal wall. Note the dimples which represent the retracted ends of the torn, atrophic sphincter ani. The shortened muscle is stretched manually so that it encircles the anal opening completely and without undue tension. The line of preliminary incision is shown. Particular care must be taken to excise all scar and granulation tissue.

Pre-operative treatment. Preparation for operation consists merely in the use of a low residue diet for 3 or 4 days before operation, and the use of soapsud enemas the night before and the morning of operation, both repeated until the solution returns clear. Violent and repeated catharsis not only annoys and weakens the patient but also may prove actually harmful by producing local intestinal irritation.

Technique. All of the lesions in this series were repaired by the same method, a variation of the technique originally described by Emmet and Hegar, and modified by Clark and Miller of New Orleans. No one of the 41 surgeons represented in the 205 cases operated on more than 13 patients.

General anesthesia was used in 133 cases or 55 per cent, spinal analgesia in 82 or 40 per cent, parasacral analgesia in 6 or 3 per cent, and local analgesia in 4 or 2 per cent. The average duration of the operation was 47 minutes.

The successive steps of the operation (Figures 2 to 7) include: the incision; the complete excision of all scar and granulation tissue; separation of the rectal and vaginal walls; isolation of the torn sphincter ends; closure of the rectal tear; approximation of the sphincteric ends; approximation of the perirectal tissues; repair of the levator ani musculofascial sling overlying the rectum; conclusion of the perineorrhaphy. Colporrhaphy, plication of the rectum, and other additions and variations are introduced according to the indications of the individual case.

Even more than is true of other surgical procedures, the successful repair of obstetric injuries is based upon a detailed knowledge of the regional anatomy (Fig. 1). The observance of certain fundamental surgical principles and certain technical details is also important. These include:

1. The relation of the time of repair to parturition. If the patient has been delivered in hospital, excellent results may be anticipated following immediate repair of fresh lacerations. Equally good results are likely to follow primary or secondary repair of old lacerations at subsequent deliveries. If, however, the repair is not done immediately after delivery, or if the primary repair has not been successful, further attempts should be deferred for at least 6 months. Such a delay will permit proper involution of the parts and the second operation will not be complicated

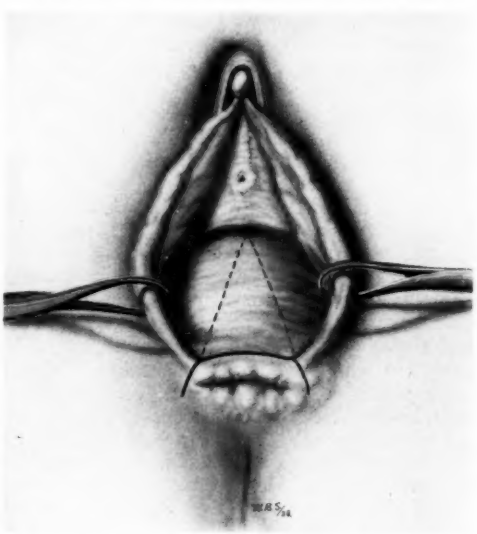

Fig. 3. Complete laceration of the perineum with coexistent rectocele. Line of incision shown. When this complication exists, it is imperative that high colporrhaphy and plication of the rectum be added to the usual perineorrhaphy and approximation of the severed ends of the sphincter ani muscle.

by excessive hemorrhage, extreme friability of the tissues, or postoperative infection.

2. An exceedingly careful aseptic and antiseptic technique. Because the surgeon must work in an area which is never free from contamination, unusual precaution is necessary to prevent the development of infection.

3. The complete excision of all cicatricial tissue, and the removal or freshening of granulation tissue, because healing does not occur readily in tissues in which the blood supply is inadequate.

4. A careful reconstruction of the torn parts, on an anatomical basis, to facilitate primary healing.

5. Approximation of tissues without devitalization. Freedom from tension is imperative. The sutures must be very carefully placed, they must not be tied too tightly, and large masses of tissue must not be included within them.

6. Restriction of the surgical procedure to the repair of the perineal tear, no matter how strong is the temptation to perform other necessary surgery, particularly abdominal surgery, at the same time.

Postoperative treatment. Postoperative treatment is directed toward two ends, the prevention of infection, and the elimination of strain on the newly repaired tissues. Infection is guarded against by ordinary cleanliness and by routine perineal care after each defecation and urination. The parts are irrigated externally with warm saline solution and dried lightly with sterile gauze, after which the operative site is painted with 5 per cent mercurochrome solution. Neither vulvar nor perineal pads are used in this operation.

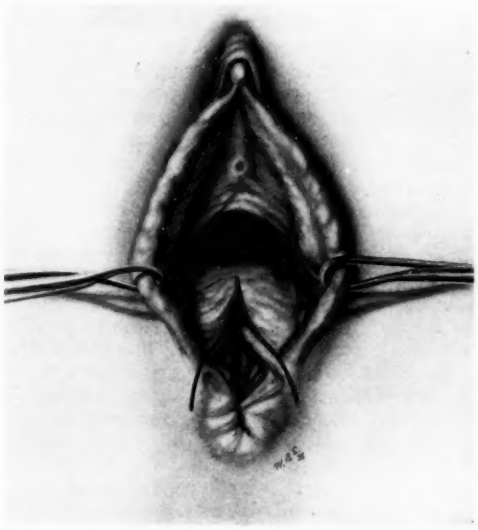

Fig. 4. Complete laceration of the perineum with tear of the anterior rectal wall. The line of incision extends downward over the sphincter pits, affording good exposure and easy access to the ends of the torn sphincter ani, the rectal canal, and the levator ani muscles.

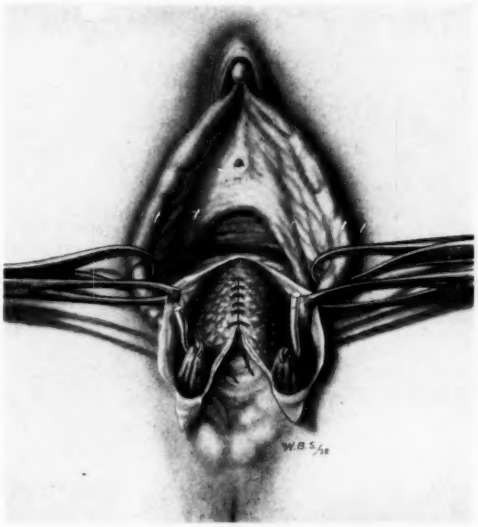

Fig. 5. The rectal and vaginal walls are separated by a combination of sharp and blunt dissection. Thorough denudation of the perineum is essential. The ends of the torn sphincter ani muscle are isolated and grasped with Sheppard hooks preliminary to approximation with interrupted 40-day No. 1 chromic catgut sutures. The tear in the rectal mucosa is closed with interrupted No. 2 linen sutures, and the knots are tied within the bowel lumen.

In order to prevent all tension on the suture line from movements of the body, the legs are fastened together until the patient recovers from the anesthesia, and the restraint is continued if she is unco-operative or unduly restless. In the average case the first defecation is postponed for a week after operation, although some authorities consider this precaution unnecessary and advise the free use of mineral oil within 1 or 2 days. This plan is apparently without ill effects, for certain patients in this series who had spontaneous bowel movements within 36 hours apparently progressed as well as the patients whose bowels were kept locked.

Our postoperative routine includes the following measures:

Fig. 6. The perirectal tissues are approximated by means of plain No. 0 catgut sutures. The levator ani musculofascial sling overlying the rectum is carefully repaired. It has been emphasized that properly reconstructed levator ani muscles can produce satisfactory bowel control, even in the absence of sphincter ani fibers. Note the re-enforcement sutures uniting the sphincter ani and levator ani muscles. The tissues are approximated without undue tension, dead space is obliterated, and absolute hemostasis is secured.

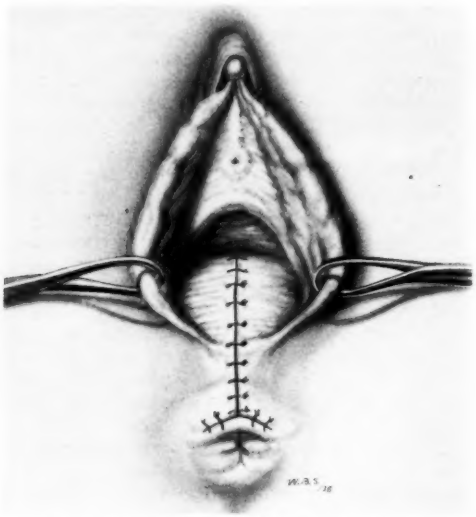

Fig. 7. The perineal body is restored in the usual manner. A coexistent rectocele should be repaired. The anus is anchored to the skin margin with interrupted 40-day No. 1 chromic catgut sutures. A vaseline pack is placed in the vagina, to remain for 48 hours, and a retention catheter is inserted into the bladder.

1. A liquid diet for 7 days, which permits broths, gruels, and fruit juices, but not milk. Soft diet is ordered for the next 7 days, and then the usual diet is resumed.

2. Opium pills (gr. $\dot{\tau}$) or paregoric ($3\dot{\tau}$) three times a day for 5 days.

3. Mineral oil ($\bar{3}\dot{\tau}$) three times a day after the fifth day.

4. Epsom salts or citrate of magnesia as necessary after the sixth day.

Enemas and rectal irrigations are not permitted, and defecations are produced solely by the use of laxatives. Immediately after operation the local application of an ice cap wrapped in a sterile towel adds to the patient's comfort and prevents the development of edema. Later dry heat is used to promote and stimulate healing. Hospitalization for at least 14 days is always required, and a longer stay is frequently advisable.

RESULTS

There were no deaths in this series. Infection was responsible for the immediate failure of 6 operations, in all of which the suture line broke down completely. Milder infection, usually of the stitch abscess variety, occurred in 26 other cases, but usually left no ill effects. Eight patients developed rectovaginal fistulæ, but surgical correction was required in only two cases, all of the others closing spontaneously.

Most of the anatomic results were excellent when the patients were discharged from the hospital or from the follow-up clinic. From the standpoint of function, 88.3 per cent of the patients were classed as cured at this time, 7.3 per cent as improved, and 4.4 per cent as unimproved. The evaluation of the results, both at this time and later, was critical and conservative. The criterion of cure was the complete restoration of sphincteric function, and the classification was reserved for patients who had complete control over both feces and gas. The classification "function improved" was applied to patients who had satisfactory control of formed stools but imperfect control of liquid stools or gas. Many patients in this group considered themselves cured. The classification of "unimproved" or "failure" signifies that little or no improvement in sphincter function followed the operation.

A follow-up questionnaire sent to all the 205 patients in the series produced 108 replies. Follow-

up inquiries of this sort are generally admitted to be unsatisfactory, but in this particular condition, because of the character of the symptom complex, the patient's opinion of her condition really furnishes more information than does direct inspection of the operative result. The follow-up was accomplished at intervals varying from 6 months to 9 years, and the high percentage of late cures, 81.5 per cent, and the small percentage of failures, 6.5 per cent, are very gratifying.

A certain number of patients who on their discharge from the hospital exhibited little or no benefit from operation later reported practically perfect end-results. In 2 such cases satisfactory bowel control was not attained for 6 months. On the other hand, the importance of a late follow-up is demonstrated by the fact that several patients who on discharge were classified as cured and who had sphincteric control for longer or shorter periods of time later had a recurrence of symptoms. It is significant that all these patients were elderly women, and our own opinion is that such failures might reasonably be charged to the senile changes which occur in pelvic tissues as age advances.

A most interesting feature of our follow-up concerns the subsequent obstetric history of 39 patients. Nineteen of them were operated on by us and later delivered by us. All the deliveries were conducted in the hospital, under continuous observation. One patient was subjected to cesarean section, and 17 were handled by deep episiotomy. In only 1 case did the perineal injury recur. There was a recurrence of the tear, however, in the 21 other cases in this group, in only 7 of which the delivery was conducted in the hospital and in none of which special precautions seem to have been taken to guard against a recurrence of the damage. These comparative results bear out the point we have previously made, that recurrence of the laceration is unlikely if proper precautions are taken in subsequent deliveries.

SUMMARY

1. A study has been made of 205 consecutive operations for complete laceration of the perineum, all of which were performed by the same technique.

2. The analysis includes race incidence, etiological factors, symptomatology, physical findings, and previous attempts at repair.

3. The immediate and late results of operation are reported, as is the subsequent obstetrical history of 39 patients.

4. A simple and effective method of repair is described, which was productive of almost uniformly good results in the hands of the 41 surgeons who performed the 205 operations. Underlying principles and points in technique are discussed.

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THE MANAGEMENT OF PATHOLOGICAL FRACTURES

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A REVIEW of the literature on pathological fractures reveals a scarcity of case reports dealing specifically with the effect of treatment on their rate of healing. A number of valuable reports describing individual cases or groups of related cases are extant, and several excellent comprehensive papers have been published in which are listed the diseases and abnormalities in which such fractures are known to occur, and which discuss in general the prognosis of the more common abnormalities. But the problem of treatment and its end-results has almost been disregarded.

This investigation is based upon a study of 85 pathological fractures in 59 cases for which sufficient relevant data were available to warrant conclusions concerning the effect of treatment. In addition, specific case reports of fractures occurring in lesions not represented in this collection or represented only by isolated instances were consulted for comparison. The conclusions arrived at enable one to establish certain fundamental principles in the treatment of pathological fractures in general which, it is hoped, will be of use in the general management of these cases.

ANALYSIS OF CASES

1. *Fragilitas ossium including osteogenesis imperfecta, osteopsathyrosis, brittle bones, and blue sclerœ* (28 *fractures*, 7 *cases*). These fractures all healed rapidly, often with exuberant callus, after simple immobilization or traction. However, they remained as weak at the fracture site as was the prefractured bone, and were therefore subject to refracture. Most of the deformities were due to malposition of the united fractures.

Treatment. In these patients treatment is best carried on by traction, plaster, or splint immobilization. Because of the very young age of many such patients control of the fragments is difficult and may require considerable ingenuity. However, if attended with meticulous care many of the deformities so common in these cases in later life can be avoided. The patients should be guarded against falls or other injuries up to the age of puberty. It is noteworthy, though as yet inexplicable, that the tendency to fracture is less, and as a corollary, the strength of repair considerably greater after puberty. Kaplan has noted this fact in a fully observed family group in which fractures ceased with the normal onset of menstruation in the female members.

2. *Carcinoma* (*metastatic*). Four of 12 patients lived and were treated 2 to 4 months after fracture and 5 more were known to have lived more than a month. None showed any deposition of callus or other evidence of union. However, histological evidence for the existence of some degree of reparative osteogenesis has been presented in such cases, and instances in which clinical union has occurred can be found in Eliason, Welch, Handley, and Hummel. In none of these authors' cases was there evidence presented of true osseous healing. Handley states that clinically healing occurred with or without radiation. In only one of the present series was radiotherapy exhibited.

Treatment. Simple immobilization in plaster or traction, depending upon the type and location of the fracture, is the indicated treatment. In a limited number of cases clinical or fibrous union takes place and the patient is rehabilitated during the remaining life span. Healing is considerably retarded and, therefore, in successful cases the part requires brace or plaster protection for many weeks or even months. Radiotherapy applied locally has relieved pain in carcinomatous metastases to bone. Hence its use as a palliative measure is indicated regardless of any possible effectiveness in accelerating healing. An interesting case of a pathological fracture of the tibia near the ankle was described by Rassieur in 1921. This was due to a primary carcinoma of the skin at that area which eroded and invaded the adjacent bone. The ulcerated skin had been under local treatment when the bone fractured almost spontaneously. The leg was immediately amputated. This treatment is obviously indicated by the pathological lesion even without fracture.

3. *Bone cyst* (7 *cases*). In a metacarpal the fracture healed in normal time and showed considerable replacement of bone when last seen. In the humerus of a boy 6 years of age the fracture healed in 4 weeks and the cyst was filled almost completely by bone 3 months later following treatment by simple immobilization. In the fibula of another patient a fractured cyst healed in nor-

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Fig. 1. a, left, Giant cell tumor; fracture. b, Giant cell tumor; fracture healed.

Fig. 2. a, left, Gaucher's disease; fracture. b, Gaucher's disease; fracture healed.

mal time following immobilization, but the cyst itself remained unchanged 1½ years after fracture. Curettage and the placing of bone chips within the cavity at that time caused rapid regeneration of bone. In 3 other patients in whom curettage and bone chips were used healing and bone regeneration within the cyst followed rapidly.

Treatment. In the treatment of bone cyst fracture healing may be anticipated following simple immobilization. However, in any but the very small lesion the cyst will in most cases remain unchanged leaving a *locum resistentiæ minoris.* Hence, curettage of the cyst with insertion of bone chips and open reduction of the fracture is recommended as the procedure of choice in these cases. Immobilization will not need to be prolonged beyond 4 or 5 weeks in the upper extremity, but its duration in fractures of the lower extremity will have to be determined by x-ray study of the strength of local repair.

4. *Giant cell tumor* (5 *cases*). In 2 patients treated by curettage and the placing of bone chips within the cavity the fractures healed rapidly with bone replacement. In 1 patient treated by plaster immobilization and radiation callus was formed in 1 month but the bone became markedly atrophic. Three years later the cyst was still evident even though the fracture remained united. In another patient treated by curettage and radiation there was delayed union; another treated by immobilization and radiation showed union with bone regeneration visible in 3 months.

Treatment. From these cases one concludes that curettage and filling the defect with bone chips followed by plaster immobilization is the most certain and rapid treatment for pathological fracture through a giant cell tumor.

5. *Rickets* (5 *fractures in* 3 *patients*). In patients whose fractures were treated only with local measures healing time was prolonged, but union, when it occurred, was thorough. In 2 fractures which received intensive doses of vitamin D healing occurred in 4 to 5 weeks. One of these latter was a fracture of the femur. These results confirm the observations of Lereboullet and Chabrun who reported 3 cases of multiple pathological fractures in children with rickets. It has been repeatedly demonstrated that while the exhibition of vitamin D does not increase the healing rate in non-rachitic fractures, its effect is specific upon the acceleration of healing in the presence of rachitic fractures.

Treatment. Immobilization and anti-rachitic therapy lead invariably to early and firm union. Without intensive anti-rachitic therapy healing may be retarded and the callus relatively soft.

6. *Gaucher's disease.* There were 4 cases of pathological fracture due to Gaucher's disease. In 2 the tibia was involved, in 2 others the vertebræ, and in 1 of the latter the sternum was involved as well. In the fractures of the long bones it was found that with simple immobilization union was delayed 14 months for clinical union and this invited intervention. In one instance open operation was complicated by postoperative osteomyelitis, but even here union occurred after subsidence of the infection. In the vertebral fractures with immobilizing procedures the progress of the lesion stopped and the fractures were considered "healed with deformity" when the patient

Fig. 3. Osteogenic sarcoma fracture healing.

was able to walk in comfort. References to pathological fractures in Gaucher's disease are rare. No case reports could be found which discussed the fracture in relation to treatment or reported the end-result of a specific instance. Eliason stated that the prognosis of the disease is poor, but the cases reported in the present group show that union of the fracture and rehabilitation of the patient should be expected.

Treatment. In lesions of the flat bones simple immobilization or rest in bed is sufficient; a spinal brace serves sufficiently as after-treatment in vertebral cases. In the long bones the evidence from this group of cases indicates that union can be anticipated following a prolonged period of immobilization. In any event, plaster immobilization must be maintained until there is clinical evidence of union over a period of several months. Otherwise, with the lesion still present, refracture is apt to occur. In the one instance where open operation was performed infection supervened.

7. *Osteitis deformans—Paget's disease* (4 *cases*). All of these patients healed in normal time with simple immobilization. However, the regenerated bone was no stronger than the thick but fibrous bone of the prefractured stage. Fracture did not stimulate the progress of the disease nor retard it. Eliason states that union in Paget's disease is slow. However, Rogers and Ulin, reporting 8 complete cases, found callus to be "normal or probably better than normal, and the care of these fractures was not difficult." Woytek concurred in this opinion. Bloodgood states that non-union of a fracture in Paget's disease suggests the development of sarcoma.

Treatment. The 4 cases reported in this study confirm the general opinion that pathological fractures in Paget's disease heal well and in normal time following treatment by simple immobilization or traction. This need not be maintained longer than the time required for fractures through normal bone, but some form of light protection should be used for a month or 6 weeks thereafter and the patient warned about the susceptibility of any of his affected bones to refracture.

8. *Chondroma* (4 *cases*). These cases all occurred in the phalanges and metacarpals. All healed rapidly with regeneration of the lesion following curettage and the insertion of small bone chips. There were no cases of simple chondroma with pathological fracture of the long bones. These observations are in keeping with the reports of others. Eliason stated that chondroma fractures do not heal until the tumor is excised. Weinberg, studying 160 pathological fractures in 1,700 bone tumors, stated: "In cartilagenous tumors involving the long bones, with medullary destruction, a pathologic fracture is usually an indication of some variant of chondrosarcoma."

Treatment. Curettage, the insertion of bone chips, and immobilization from 6 to 7 weeks is the indicated procedure for these patients.

9. *Osteofibrous dysplasia including localized osteitis fibrosa cystica and osteofibrous dystrophy* (3 *cases*). In these patients the fractures healed in normal time when treated by simple immobilization. Regeneration of bone through the underlying lesion followed treatment with or without surgical intervention. When curettage and the insertion of bone chips was performed, regeneration proceeded much more rapidly than when these measures were not employed.

Treatment. These cases were too few in number to warrant final judgment. Previous reviews of pathological fractures quoted above agree in the general statement that these fractures heal in normal time with some instances of coincident filling of the defect following simple immobilization. On the basis of the present cases and compared with other similar lesions one might state, in the absence of further series of specific case reports on the subject, that these fractures invariably heal under conservative treatment, but that the lesion in most instances remains a locus resistentiæ minoris unless curetted and unless osteogenesis is stimulated by the insertion of bone chips. The necessity for removal of the adventitious tissue in the treatment of these fractures should be judged by the location of the lesion at points of excessive strain in the extremities and by the relative volume of the bone segment affected.

10. *Osteogenic sarcoma.* Two of the 3 patients showed evidence of healing before death. In 1 of these a fracture of the shaft of the femur was sufficiently well healed 6 weeks after it occurred to permit walking. Treatment in each patient consisted of (1) plaster and (2) plaster and radiation. In the third patient the sarcoma was progressively destructive until death. Radiation was used in 1 of the united cases and not in the other. It was also used in the progressively destructive case.

Treatment. Plaster immobilization is indicated. Radiation may be used to palliate pain but will not contribute to healing. Duration of the period of immobilization can be determined only by x-ray observation, although after evidence of clinical union a splint for the upper extremity or brace for the lower may be suitable.

11. *Neuropathies, including paralysis agitans, poliomyelitis, tabes, general paresis, syringomyelia, spina bifida.* In 2 out of 3 fractures in this series healing occurred in normal time following simple immobilization. There were 2 cases of paralysis agitans and 1 of poliomyelitis. The prognosis is said to be good in tabes (9) and syringomyelia (17). Bloodgood noted that fractures in tabes are most common in the lower extremities, and in syringomyelia in the upper extremities. Achard, and Sicard and Roger, have reported cases of pathological fractures in tabetics with healing following immobilization, massage, supervised active motion, and anti-luetic therapy. Alajouanine, Mauric and Camus reported a healed case in syringomyelia following conservative therapy. Camus found 18 cases of pathological fracture in syringomyelia in the literature up to 1927. Healing always takes place, though retarded, with conservative therapy. Trumpeer and McNealy reported 2 cases of fracture in poliomyelitis and noted that while healing takes place under conservative therapy the resultant callus is weak, because the "functional stimulus is absent."

Fig. 4. a, left, Bone cyst; fracture. b, Bone cyst fracture healing.

Fig. 5. a, left, Luetic osteoperiostitis; fracture. b, Luetic osteoperiostitis; fracture healed.

Treatment. Immobilization procedures are sufficient in these cases and healing will take place in normal time, but the part must be protected against refracture for a prolonged period. Early functional stimulation with protection is the most effective treatment.

12. *Osteomyelitis (2 cases).* These fractures will unite with simple immobilization when the osteomyelitis is in the regressive or healing stage. When the infection is actively progressive, it will destroy the newly formed bone more rapidly than callus can be deposited. Capener and Pierce studied 18 cases of pathological fracture in osteomyelitis. In 9 patients firm union was eventually obtained, though often considerably delayed.

Treatment. Fracture is a complication of chronic osteomyelitis and is almost invariably preventable. It occurs most often in bone following extensive saucerization when the structure is weakened. This should be kept in mind and protection afforded to a saucerized bone even in the upper extremities until such time as sufficient repair is present to assure stability. When it occurs in an active or progressing infection, the area should be completely saucerized not only as treatment for the osteomyelitis but also to insure union. Following this the bone should be completely im-

mobilized until union takes place and until the osteomyelitis has either been removed or become quiescent.

13. *Endothelial myeloma (Ewing), hypernephroma, multiple myeloma.* Since these 3 malignant neoplasms produce similar lesions structurally, in bone, though histologically different, their treatment is the same. One such case, that of a Ewing tumor, involving a cervical vertebra was among the present series. No union could be discovered at the time of death 2 months later. However, in Coley and Sharp's paper 5 cases of Ewing tumor are cited in which healing did occur. Rypins reported a case of hypernephroma with pathological fracture through metastases in the bones of the forearm which later united. Gottesman, Perla and Elson studied 44 cases of hypernephroma and found no evidence of healing in any of their series when pathological fracture occurred. Bloodgood found 1 example of ossification in a fracture through multiple myeloma and 1 through hypernephroma.

Treatment. Radiation is exhibited as a palliative measure. Beyond this, simple immobilization by traction or splint will help to relieve pain. Union is most exceptional and cannot be anticipated.

14. *Syphilis and syphilitic osteoperiostitis.* In 1 case of fracture through a bone rarefied by luetic osteoperiostitis there was complete restitution to normal in 2 months following immobilization of the fracture and anti-luetic treatment. In a second case a pathological fracture occurred in a luetic patient without evidence of local bone inflammation. This case healed well without any immobilization; only the radius was fractured at its mid-shaft without displacement, and following anti-luetic measures resumed a normal appearance. Sézary and Jonesco reported an instructive case of repeated pathological fractures in a non-tabetic luetic patient in which final cessation of fracture followed intensive anti-luetic therapy. Galliot also published an excellent review of pathological fractures in acquired syphilis, including an extensive bibliography. His experience as well as that of Grunert, in 1905, confirms the 2 observations reported in the present series.

Treatment. When pathological fracture occurs in a luetic patient immobilization or traction supplemented by active anti-luetic measures is the treatment of choice. One may thus anticipate complete restitution of the bone structure to normal within the time ordinarily allowed the same fracture in a non-pathological bone and avoid a repetition of pathological fracture elsewhere in the skeleton.

15. *Fibrosarcoma.* The present case could not be duplicated in the literature available. A fibrosarcoma involving the upper end of the femur was excised and bone chips were inserted. The fracture was united 9 months later. However, this procedure cannot be advocated as one of choice, and the case must be considered an exceptional instance of low grade malignancy.

Treatment. Such patients are to be treated as are those with pathological fractures through osteogenic sarcoma (vide supra). The above sections discuss pathological fractures represented in the present series or those whose lesions are closely allied to them in structure and effect on bone. Other susceptible lesions will be mentioned briefly only where published case reports include a description of the treatment and the end-results. References to such lesions will be cited in the bibliography without further discussion.

ANALYSIS OF ADDITIONAL LESIONS

1. *Osteopetrosis, marble bones, Albers-Schoenberg's disease.* These unite promptly with conservative therapy, but in spite of the hardness of the bone and its implied durability the bones are fragile and a tendency to fracture increases with the progress of the disease (19). Because of this Pirie preferred the term "chalky bones." Merrill reports a case in which 4 fractures occurred, 3 being local recurrences. In each patient union occurred following conservative care (22). Compere saw 12 cases of marble bones with 5 fractures. These united well but recurrences were frequent up to the age of 30.

2. *Multiple spontaneous idiopathic symmetrical fractures, osteoporosis melolytica.* In these patients no clinical union occurs and the slow dissolution of continuity of the bones proceeds (20, 23). Brailsford, contrary to other authors, classifies these cases among the osteomalacias.

3. *Osteomalacia including hunger osteopathy, status cachexia, steatorrhea.* Kurtzahn reported a series of cases in 1929. Goisman and Compere, studying 10 cases of fractures in atrophic bone, gained the impression that "union occurred as readily in fractures of atrophic bones as in fractures of bones of normal density." (See also 32, 35.)

4. *Senile atrophy, atrophy of disuse.* Westphal found that atrophic bones associated with joint tuberculosis heal normally.

SUMMARY AND CONCLUSIONS

1. Fifty-nine patients in whom 85 pathological fractures occurred were studied in reference to the effect of treatment on union. In each patient the pathological lesion or skeletal abnormality was

known, and sufficient clinical and roentgenological data were available to warrant conclusions. These were compared to case reports available in the literature. From this material it is possible to evolve certain rules or principles which, it is hoped, will assist in formulating treatment applicable to pathological fractures in general, whether the underlying pathology be unique, rare, or relatively common.

2. Trauma is in itself always a stimulus to reparative osteogenesis in pathological fractures.

3. The extent of repair in pathological fractures is a function chiefly of the density of pathological tissue displacing bone and/or the volume of displaced bone requiring replacement.

4. The strength of reparative tissues when fully formed depends upon several factors: (1) the inherent soundness of the prefractured bone, as in fragilitas ossium, osteopetrosis, or certain of the atrophies; (2) the available mineral content, as in rickets; (3) the progress, stasis or regression of the pathological lesion, as in osteomyelitis or certain neoplasms; and (4) the amount of viable bone which can be formed in the space permitting its deposition, as in the osteofibrodystrophies.

5. Reparative osteogenesis can be stimulated greatly in selected cases by curettage of the pathological tissue and deposition of bone chips. In certain lesions such as giant cell tumor or bone cyst, in which union may occur under conservative care, this procedure will hasten and strengthen repair. Operation is especially indicated in cystic lesions or in those in which solid areas of bone are displaced, as distinct from those in which the pathological lesion merely permeates existing trabeculæ.

6. Union between the residual normal bone adjacent to a persisting lesion is an invitation to refracture. Whenever feasible, that is, when not specifically contra-indicated by the pathology of the lesion, its removal and replacement by bone chips is advisable.

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THE DIAGNOSIS OF PANCREATIC DISEASE

SINCE the year 1927 which was also the date of the publication of Robert Coope's monograph, *The Diagnosis of Pancreatic Disease*, there has been a rapidly growing interest in surgical diseases of the pancreas, despite the low morbidity index for this organ. That this is true is evidenced by the considerable number of papers on clinical and experimental aspects of pancreatic disease appearing in the literature. The problems concerned with diagnosis and differential diagnosis are of the greatest importance and have received much attention. The history, physical findings, routine laboratory studies, and roentgen examination have all too frequently yielded inconclusive diagnostic data. This fact led to the development of special diagnostic procedures which attempted to detect the failure of the discharge of pancreatic juice into the duodenum, such as for example, the appearance of bulky stools, indoxyluria, the absence of pancreatic ferments from the stomach, duodenum, and feces, and the excess of nitrogen and undigested muscle fibers and fat in the feces.

In addition to these more direct measures others less direct were advocated and efforts were made to obtain diagnostic information by introducing substances into the gastrointestinal tract, normally digested by pancreatic juice. The glutoid capsule test of Sahli and Schmidt's beef cube test were notable examples of this type of study. The carbohydrate metabolism was also investigated by means of quantitative blood sugar estimations and sugar tolerance tests, and inferences as to the functional state of the pancreas were made on the basis of these determinations. Some of the tests proposed now seem almost fantastic, and Coope refers to such procedures as Loewi's adrenalin mydriasis test and particularly Cammidge's urine test as "esoteric." Most of these methods are now obsolete and rarely used.

When Wohlgemuth, in 1908, made observations on the diastase of the blood and urine in health and disease, a new and more rational avenue of approach to the problems of diagnosis in diseases of the pancreas was opened. In clinical practice, it was early recognized that in a number of diseases of the pancreas the concentration of diastase in the blood and in the urine was elevated above the normal level. Observations of experimental physiologists had shown that when the pancreatic ducts in animals were ligated, the diastase of the blood became enormously increased. A number of ingenious methods have been proposed for the quantitative determination of the diastase concentration in the blood and urine. The four principal methods described

in the literature are: (1) the iodometric; (2) the copper reduction; (3) the viscosometric; and (4) the polariscopic. In 1938, Somogyi declared that all existing micro-methods were inadequate for the quantitative measurement of diastase and proposed a modification of the Wohlgemuth test which in our opinion is simple, rapid, and accurate.

Unfortunately the rise in the diastase of the blood, due to stasis of the pancreatic juice, localized either to a portion of the gland or generalized throughout, is transient and rarely lasts for more than a few days. Many surgeons and clinicians now recognize this limitation of the test but as yet it is not generally appreciated. The following explanation for the behavior of the diastase curve seems logical. Any pathological process causing mechanical obstruction such as calculous inflammation, cyst, or neoplasm interferes with the free discharge of pancreatic juice and results in a damming back of the external secretion; the ferments then become concentrated in the blood stream and are gradually eliminated in the urine. If the obstruction continues, pressure atrophy of the acinar cells develops and the elaboration of the ferments cease; the diastase in the blood soon returns to normal or nearly normal levels where it is probably maintained by the liver. Obviously the interpretation of the diastase values at this time may be very misleading. The test has been of greatest value in the acute forms of pancreatitis. In cyst of the pancreas it is said to be positive in about 50 per cent of the cases, while in chronic pancreatitis and in neoplastic disease the determinations are often of little or no value.

Other methods for dealing with this problem have been studied experimentally. The excretion of various dyes by the pancreas has been investigated by a number of experimentors but the results have been discouraging. The fact that the diastase in the blood of dogs begins to rise within an hour after ligation of the ducts suggests a possible line of investigation, for if the orifices of the pancreatic ducts could be temporarily occluded in some manner, this rise might be taken as an index to the functional integrity of the gland. Further research is needed.

In our opinion the estimation of blood diastase is the most valuable single diagnostic test for acute pancreatic disease known at present, but the results must be properly interpreted and correlated with other laboratory and clinical data.

JOHN M. MCCAUGHAN.

SERUM AMYLASE IN THE DIAGNOSIS OF PANCREATIC DISEASE

AMONG the more promising methods for the detection of pancreatic disease is that of determining the activity of amylase in the serum. Its beginning may be traced to Wohlgemuth, who, in 1908, described a quantitative method for measuring amylase, based on the hydrolysis of starch into erythrodextrins and maltose, using iodine as a test substance. The determination of the amylolytic activity of the serum as a method of diagnosis of pancreatic disease has been increasingly well defined during the past 30 years by accumulating experimental and clinical data, and now the method seems to be approaching maturity after many years of alternating enthusiasm and neglect at the hands of the internist.

The measurement of amylolytic activity can be accomplished either by physical or chemical methods. An illustration of physical methods is the viscosimetric method, in which the change in viscosity due to hydrolysis of starch by the enzyme amylase is measured.

Chemical methods usually depend either on measurement of the rate of disappearance of starch as determined by the color produced by iodine or by the measurement of the quantity of maltose or glucose liberated by the enzyme. The values for amylase in the serum are expressed in various terms, depending on the method used. Data collected by use of these methods have shown that amylase is constantly present in the blood stream, that in healthy individuals amylolytic activity is relatively constant, but that this activity may vary considerably in different persons. Amylolytic activity is said to be unaffected by starvation or by foods of various types.

Considerable information about the origin and fate of amylase has been accumulated and it is now believed that amylase arises, partly at least, in the pancreas. Several reasons for this belief can be advanced: First, experimental pancreatectomy performed on animals has been followed, with few exceptions, by decreased levels of amylase in the serum. Second, ligation of the pancreatic ducts of animals always has been followed within a few hours by a rapid rise in values for serum amylase, these values gradually returning to normal in 8 to 15 days. Third, pancreatitis induced experimentally by injection of bile into the pancreatic duct has been followed routinely by marked increase in concentration of amylase in the serum, maximal values being reached within 72 hours and the return to normal usually occurring within the first week, even though pathological changes persist in the pancreas. Fourth, a subcutaneous injection of acetylcholine is followed by an increase in values for amylase in the serum of the intact animal while such an increase fails to take place if pancreatectomy has been performed previously. Amylase in the serum may, however, have an extrapancreatic origin for, as McCaughan recalled, Wohlgemuth, Polacco, and Medina showed that obstruction of Stenson's duct also resulted in increased amylolytic activity of the blood and urine. Amylase in the pancreatic juice, after its entrance into the duodenum, probably is not a source for amylase in the serum since it has been shown that the concentration of amylase is not affected by drainage of the pancreatic juice to the exterior.

Amylase probably is absorbed directly into the blood stream from the pancreas in health while in the presence of experimental or clinical obstruction of pancreatic ducts, and in the presence of pancreatitis, it is presumed that rupture of small pancreatic canaliculi occurs, permitting entrance of pancreatic juice into the blood stream through the lymphatic vessels. The factors which maintain the normal concentration of amylase in the serum are not well understood. It may be assumed that the pituitary gland exerts some influence, inasmuch as removal of the pituitary glands of dogs is followed by a twofold increase in the concentration of amylase in the serum. Amylase is excreted through the kidneys and through the liver and both urine and bile probably serve as vehicles for elimination of excess amounts of amylase.

Theoretically, destruction of the acinar tissues of the pancreas should be followed by lowered values for amylase and low values have been reported in the presence of chronic pancreatitis. Low values also have been reported to have been found in the presence of cholecystitis, of various conditions of the liver such as hepatitis, cirrhosis, abscess, and carcinoma, as well as in the presence of diabetes, severe toxemia of pregnancy, and pneumonia. The finding of low values in the presence of some of these conditions is difficult to explain and suggests that the rôle of the liver in the maintenance of normal values should be investigated further. The multiplicity of conditions in which low values have been reported

renders such values of questionable significance in the diagnosis of diseases of the pancreas.

Elevated values for amylase in the serum have been recorded both in cases of inflammatory disease of the pancreas and in cases of obstruction of the pancreatic ducts by carcinoma or by cyst of the pancreas. Since elevated values persist only for a few days after the onset of inflammation of the pancreas, the determination must be carried out within this period if the result is to be positive for inflammatory disease of the pancreas. Elevated values may persist for a longer period when the duct is obstructed by neoplasm. The determination is positive for pancreatic disease with great frequency, provided the determinations are carried out within the first few days after the attack of upper abdominal pain or during the acute phase of obstruction of the pancreatic duct.

Although elevated values for amylase in the serum have been reported in the presence of nephritis, this fact should not be considered to detract from the usefulness of the determination in the diagnosis of pancreatic disease. A greater source of error in clinical application of the test possibly may arise from obstruction of the common bile duct, for it has been shown that experimental ligation of the common duct leads to increased values. Until now, elevated values have not been, and it seems unlikely that they will be, identified as being due to obstruction of the common bile duct, inasmuch as Wakefield, McCaughan, and McVicar found elevated values in only 4 of 18 cases in which the common bile duct was obstructed by carcinoma of the head of the pancreas. Even in such cases considerable doubt exists that obstruction of the common bile duct was responsible for the high values and it seems unlikely that the more incomplete and more transient obstruction caused by stone in the common duct will cause elevation of values for amylase in the serum and thus prove a significant source of error in the clinical application of the test.

Although it is true that elevated values do not necessarily mean pancreatic disease, elevations due to other causes should not often confuse the diagnosis, and it seems safe to conclude that elevated values will point to inflammation of the pancreas or to obstruction of the pancreatic duct with a high degree of certainty. The determination of the concentration of amylase in the serum seems to be well established as a test of pancreatic disease and should be more extensively used in the diagnosis of disease of this organ. M. W. COMFORT.

MEMOIRS

DR. WILLIAM J. MAYO AS I KNEW HIM

OWEN H. WANGENSTEEN, M.D., F.A.C.S., Minneapolis, Minnesota

DR. WILLIAM J. MAYO is dead.

Born into a country physician's family in Le Sueur, a small frontier village in Minnesota, in the early days of the American Civil War, he was destined to become the first citizen of the commonwealth of Minnesota and a figure of the first rank in the world of medicine, bringing undying luster to the name of Mayo and enduring fame to Rochester, Minnesota, where he lived and worked.

Dr. Mayo was a man who would stand out in any group of men. He was of medium height; his bearing was erect, his step quick and firm, even in his later years and his alert eyes were steady and intent. In manner he was unpretentious and a quiet dignity characterized his every action. His conversation was lively and cheerful and gave evidence of a broad general interest. His capacity for reducing important principles whether in discourse or writing to an apologue or illustrative anecdote was proverbial and all his expressions were uniformly moderate in statement. Dr. Mayo was a good listener and lent an attentive ear to any conversation to which he was a part. His extraordinary memory for face and fact was in part owing no doubt to the earnest and concentrated interest which he lent even casual meetings.

What was the philosophy of life of this remarkable man who in a small midwestern town, with the aid of his brother Dr. Charles H. Mayo, built a medical clinic that has been long the wonder and marvel of the entire world? Frugal and abstemious in habit, simple in tastes, and temperate in all things but work, his daily example illustrated the great principle which regulated his life and which he himself expressed so well: "Contented industry is the mainspring of human happiness." From earliest years to his last he loved his work. There were no spasms or episodes of labor. His life was a long, patient, and continued effort. What is labor when the sun of success shines upon a man's exertions? When Dr. Mayo gave up his work in the operating theater, which he loved so much, at the age of 68, his other clinical activities absorbed his entire time and interest. He remained always a perpetual wonder to his associates who could not understand how he could find complete satisfaction and enjoyment in constant hard work. When he needed relaxation, he found it in some other activity. Diversions of the vacant hour were the companionship of his family, thoughtful reflection upon

the verities of life, reading, travel, and his river boat. In his active years he seemed indefatigable and under whatever stress he found himself, he exacted always a higher standard of work from himself than from his associates. A noble maxim, dear to his heart, which adorned his desk, animated his work and gave it direction. It read: "He loved the truth and sought to know it."

What were the qualities of this man that made it possible to accomplish in a single life span the Herculean tasks which he carried through? A lofty objective with earnestness and singleness of purpose, unrivaled capacity for leadership, unsurpassed vision, a well balanced critical but tempered judgment, an ability to make time go a long way, indomitable determination, flexible adaptability and a genuine tolerant sympathetic patient understanding, accompanied by a calm serenity, were some of the characters that set Dr. Mayo aside from other men.

How Dr. Mayo succeeded uniformly in getting everyone about him to do his bidding willingly is a source of never ceasing wonder. Since the beginning of time, the distinguishing mark of eminently successful leaders has been the dual capacity to envisage a far reaching intelligent program and the ability to carry it through with the complete and voluntary consent of the governed. Dr. Mayo possessed both these talents in liberal measure. To command the complete confidence and loyalty of associates in undertakings which at the time had the suggestion of being somewhat visionary is in itself a real triumph. The success motif runs conspicuously through all activities to which Dr. Mayo put his hand. Capable generals who lose battles discover usually that their popularity was lost with the conflict. Certainly nothing succeeds so well as success. The astonishing success of his enterprise attests not alone the acuity of Dr. Mayo's unusual mental perception but as well his skill in the choice and the management of associates.

Dr. Mayo recognized true merit and rewarded it liberally. There was no envy in his make-up—no ambition to hold the stage alone. Associates were given free rein and excellent opportunities to develop their individual capacities. Dr. Mayo lent encouragement often by an unexpected kindly act or a word of praise. His criticisms were few and friendly.

Let us look at this man at work in his surgical clinic. Here it was he first established himself as a surgeon of distinction. Here again, natural endowment with rare combinations of talents permitted him to make an enduring contribution to surgery. Early world-wide recognition as surgeons came to the brothers Mayo for their ability to carry out operations upon the gall bladder, bile ducts, and stomach, with exceptionally low mortality rates. Medical men came to see, doubtful of the incredible reports they had heard and read emanating from Rochester. They came away bewildered by what they saw and, if they went to Europe, they encountered great enthusiasm for the surgery done at Rochester. Those who live within the pale of a great man's shadow are often slow to admit or

appreciate fully the things which the rest of the world acknowledged long since, until the echo of his fame returns to their very doors. The world gives its admiration not to the man who does what nobody attempts to do, but to the man who does best what many do well. The masterly adroitness of Dr. Mayo in operations upon the stomach, colon and rectum, hernia, the biliary passages, spleen, and kidney are well known to all who were privileged to observe him at work. His manipulations were delicate and precise. A fine tremor did not impair the accuracy of his handicraft. His mental calm in trying situations was admirable. He was a surgeon's surgeon, an affirmation of his superior judgment in making and executing difficult decisions. On completion of an operation, he would review in a modest chatty manner the nature of the problem as it presented itself, discussing the alternative manners in which the problem may have been solved, giving the reasons for his choice of procedure. These remarks gave evidence always of profound knowledge of the recorded experience of others tinctured by the wisdom which comes from a critical analysis of a broad personal experience. Dr. Mayo was in no sense a slave of authority; on the contrary, he was always in the lookout of the watch tower searching the horizon for new ideas. Yet, his every act indicated that he valued the knowledge of the past as a priceless possession evincing, however, the capacity to sympathize understandingly with other times.

Dr. Mayo found the surgeon working alone with assistants of a kindred spirit in his workshop. He succeeded in exciting the curiosity successively of pathologist, roentgenologist, and internist in surgical problems and brought into the surgical clinic the experience of a group of men whose special knowledge pyramided the usefulness of the surgeon. This contribution of Dr. Mayo has left an indelible impress for the better on the practice of medicine that has been felt around the world. Wherever this principle of surgical practice is in force one can be certain that the surgery is of a high order. Dr. Mayo's recognition of the importance for the surgeon to limit his activity to a somewhat circumscribed field has done much to advance surgical specialism in this country. One who essays to encompass the entire field of surgery remains all his life a learner and can make no significant contribution to the patrimony of surgical knowledge. Dr. Mayo did insist, however, that every surgical specialist must be grounded broadly in the province of general surgery.

Having co-ordinated intimately the activities of his clinic, this man, who saw with extraordinary perspicacity, placed his institution in part under the observant discipline of a graduate school of medicine with university supervision. Obstacles did not deter him. He established an experimental laboratory of surgery, brought bacteriologist, chemist, biochemist, physicist, and biophysicist into intimate contact with many phases of the practical work of the clinic long before this practice was the fashion or its great value to a clinic appreciated. Little wonder that this practical dreamer's vision has made of his effort a monument that attracts

medical men and patients from everywhere. The innovations which Dr. Mayo made in clinical and hospital procedure indicate that he meditated and reflected continuously upon new schemes and disciplines which could be introduced for the betterment of medical practice. He was always in the vanguard of progress.

Dr. Mayo's interest in the young man was unceasing. He urged the young aspirant, ambitious for a career in medicine, to give intelligent thought to the general problem of social conduct and relations to his fellow man. Many a man who professes the moral code employs it as a lightning conductor. For Dr. Mayo it was the guiding light of his daily life—an obligation indispensable to happiness. Another precept to which Dr. Mayo lent directional momentum, not alone by repeated exhortations but by the more cogent impetus of example, was the necessity for systematic and continued study. A man of improved faculties, Dr. Mayo counselled, has command of another's knowledge. He felt keenly that the wisdom of age and experience should be exchanged freely with the enthusiasm of youth and that both old and young would benefit greatly by the barter. Said Dr. Mayo: "As I have watched older men as they have come down the ladder, as down they must come, with younger men passing them, as they must pass to go up, it so often has been an unhappy time for both. The older man is not always able to see the necessity or perhaps the justice of his descent and resents his slipping from the position that he has held, instead of gently and peacefully helping this passing by assisting the younger man."

Despite the absorbing nature of his work, Dr. Mayo found time for many other activities. For a period of thirty-two years he was a Regent of the University of Minnesota and took a very active part in the deliberations of that body. During this long period of service he cultivated constantly an intense interest in the broad outlines of general education and gave special attention to the history of education. His opinions upon educational matters were respected and he was much sought after as a speaker at university exercises. He gave much thought to medical education, both undergraduate and graduate, and took an active interest in the efforts of established medical organizations to improve and elevate the general plane of practice. Since its beginning, he was identified intimately with SURGERY, GYNECOLOGY AND OBSTETRICS and participated actively in the functions of the American College of Surgeons.

One of the very beautiful and exemplary things relating to the brothers Mayo was the devotion and attachment of one to the other. It was more than a fraternal interest, yes, something akin, in each instance, to that of a father's solicitude for his son, a spirit which we would all do well to emulate. Doctors Will and Charlie, as they were affectionately known to their intimates, spoke often with a tender fondness of the lessons they had learned from their parents. Dr. Will credited his father with many an important precept that stood him in good stead throughout his professional life. To both his mother and his father

he attributed prudent instructions in social obligations—of which his entire life reflected an unusually fine appreciation. Together the brothers Mayo gave liberally of their earnings to the Mayo Foundation for Graduate Medical Study and Research. In all, two and a half million dollars was donated by the brothers Mayo for this purpose. In a letter addressed to the University of Minnesota accompanying the last gift, Dr. Mayo expressed in beautiful and simple language the philosophy that had prompted their philanthropy. He said in part: "Our father recognized certain definite social obligations. He believed that any man who had better opportunity than others, greater strength of mind, body, or character, owed something to those who had not been so provided; that is, that the important thing in life is not to accomplish for one's self alone, but for each to carry his share of collective responsibility. . . . The fund which we had built up and which had grown far beyond our expectations had come from the sick, and we believed that it ought to return to the sick in the form of advanced medical education, which would develop better trained physicians, and to research to reduce the amount of sickness. . . . The people's money, of which we have been the moral custodians, is being irrevocably returned to the people from whom it came."

Many honors from all parts of the world came to the brothers Mayo, and their list of citations, decorations, and honorary degrees is most impressive. Both brothers valued these manifestations of esteem of their fellow men, but honors were held lightly by these modest and good men who retained their simplicity while occupying high positions in the world. Both the Doctors Mayo were loyal, law abiding, peace loving patriots, ardent in undivided devotion to their country which had rewarded their dreams and ambitions far beyond their most sanguine expectations.

Men like Dr. William J. Mayo, who are destined to guide the fate of empires or great enterprises, can not enjoy or gratify their capacities for friendship to the fullest. It is inevitable that they must often walk alone and keep their own counsel, however much they would share their hopes and reveries with their intimates. It is to the glory of Dr. Will, however, that in the circle of his friends and associates he was loved even more than he was honored. Dr. Mayo was a very domestic and home loving man. The deep ties of affection to his family and kin were beautiful to behold. The door of the Mayo household was open always to friend and stranger who shared his interests, and the generous cordial hospitality of Dr. and Mrs. Mayo excited the warm admiration of all who were fortunate to know it.

Sweet is the recollection of this kindly man of rare gifts. His memory falls tenderly, yet sadly on the spirit. His remembrance will be cherished with pride and affection by those who were privileged to know him. He belongs now to the infinite. His name will not perish in the dust.

THE SURGEON'S LIBRARY

REVIEWS OF NEW BOOKS

THERE has been a definite need for a book in the English language on the subject of *Orthopedic Appliances*.[1] The book by Dr. Jordan meets this need. The advantages and disadvantages of orthopedic appliances are noted, and the principles of application, technique of construction, and method of fitting mechanical supports are described. The author stresses the need for co-operation between the surgeon and the bracemaker and points out the responsibilities of each.

The book is useful to all who prescribe orthopedic appliances. The responsibility of choice of brace and supervision for proper fitting falls upon the surgeon who prescribes the appliance. It is also useful to the bracemaker. Technical details are clearly stated for the bracemaker to follow as to choice of material and methods of construction. The book is arranged so that it can be used as a reference to find a desired type of appliance; the appliances are grouped according to the anatomical parts to be supported and protected. It contains a chapter on the construction of several types of arch supports.

Dr. Jordan reveals his continental training. He emphasizes the value of thorough, exact workmanship, and shows a preference for form-fitting braces. He also considers conditions in this country and takes into consideration the increased expense as well as the need of expert bracemakers in the construction of form-fitting braces. His use of a brace as a corrective mechanism is ill-advised. The deformity should be corrected first, and the brace constructed to retain the correct position.

The author describes methods of constructing models and of taking measurements from which braces can be made. He describes and illustrates braces which have been proved by clinical use, including some which are outmoded and others which have not been described previously in the English or American literature. EMIL HAUSER.

THE new edition of Means' and Richardson's work, *The Diagnosis and Treatment of Diseases of the Thyroid*[2] covers the field simply but thoroughly, and is based on the extensive experience of the thyroid clinic of the Massachusetts General Hospital. Each chapter is followed by a bibliography of the important literature so that this volume becomes a valuable reference work. Approximately 50 selected case histories, illustrating problems of diagnosis and methods of management, are used throughout the discussion. The gradual swing away from x-ray to one-stage surgical treatment of exophthalmic goiter is tabulated by 4-year periods in the material extending from 1915 to 1935. The treatment of hypothyroidism is given in detail. The work is representative of the common sense, accurate, and complete medical practice of this group. PAUL STARR.

ONE may almost unconsciously accept the author's "semi-humorous" style in reading one of his books. He has left this mouth and jaw subject until the last, and in his book, *Surgical Pathology of the Diseases of the Mouth and Jaws*[3] states, "so after thirty-five years of writing, I shall trade my pen for a lollipop," but he does not *promise* to do so.

Whatever feelings a reader may have toward the author's homely style, fairness will show that an established principle for the good of the individual patient has been faithfully and admirably followed out; and a reader will only fool himself if he assumes that all the necessary "science" is not also included in the pages. The reader may be amused by such passages as the following: "It is a question whether the lips should be considered a part of the face or as belonging to the oral cavity. The young swain, no doubt, regards them as part of the face. Generally speaking, however, their most salutory function is to act as a portcullis for the oral cavity and to prevent the emission of sounds the unguarded vocal cords may feel impelled to emit." But there can be little doubt that the author has an unusual ability to reduce to words the processes one automatically goes through in arriving at a diagnosis.

The book is said to be intended for general surgeons; but there are so many statements regarding the importance of diagnosis for correct treatment, and so many sallies into the field of treatment, that one may wish the author would break down and go ahead with a full discourse on treatment of all the lesions included.

One finds good, definite statements on microscopic confirmation of diagnosis before reporting cures of carcinomas, on the seriousness of lip carcinoma, on the unimportance of "too much education" in the pathology of jaw tumors, on the unimportance to the patient of theoretical discourses on mixed tumors, and regarding many other subjects that usually are discussed at great length.

[1] ORTHOPEDIC APPLIANCES; THE PRINCIPLES AND PRACTICE OF BRACE CONSTRUCTION FOR THE USE OF ORTHOPEDIC SURGEONS AND BRACEMAKERS. By Henry H. Jordan, M.D. Foreword by E. G. Brackett, M.D. New York, London, Toronto: Oxford University Press, 1939.

[2] THE DIAGNOSIS AND TREATMENT OF DISEASE OF THE THYROID. By James H. Means, M.D., and Edward P. Richardson, M.D. London, New York, Toronto: Oxford University Press, 1938.

[3] SURGICAL PATHOLOGY OF THE DISEASES OF THE MOUTH AND JAWS. By Arthur E. Hertzler, M.D. Philadelphia, Montreal, and London: J. B. Lippincott Co., 1938.

The photomicrographs are so clear that many of them look like drawings; the photographs are also good and, although one wonders why the entire face is included for small lip lesions, by the time the middle of the book has been reached, it just seems a nice personal introduction to see a tumor of the tongue shown in a patient with nose glasses. On page 189, however, toward the end of the book, the full face cadaver with the blotch on the palate described as a fibroma may leave one in deathly fear of such a process.

The author has experienced control of bleeding in malignant jaw tumors by external carotid ligation; but perhaps by some surgeons, who have not had such good success with this procedure, one small mark may be made against the author's recommendations.

One who does this type of work will be glad to welcome the present text as a standard reference, and will be delighted that the author found time to include this work in his series of 10 monographs on surgical pathology. JAMES B. BROWN.

IN this compact little book, *Le traitement non sanglant des fractures du rachis*,[1] Mallet-Guy appraises the technique of Davis, Watson Jones, and Boehler in their orthopedic, non-operative treatment of fractures of the spinal column, with emphasis on his own refinements and modifications of that form of treatment in the light of his own experience. He has personally treated by this method a series of 34 cases of fracture of the spine, and in collaboration with René Leriche he has had the opportunity to extend his observations. Briefly, the author's procedure is as follows: With the patient in the ventral position on a table, and with the head and neck supported in a specially made, ingenious contrivance (to extend the spine by forcing the head back without undue strain on the atlanto-occipital articulations), the muscles in and about the site of the fracture are thoroughly infiltrated with 1 per cent novocain solution, and the spine is hyperextended as far as possible. A posterior molded body cast is fitted, dried, and completed the next day by an anterior molded half, and the patient is then allowed to be up and about in order to perform specially designed exercises.

The author recognizes the fact that basically the idea of such treatment is not his, but it is his purpose to stress its value in the treatment of old or recent spinal fractures (without attendant neurological lesions), and to point out the special advantage of the use of novocain rather than a general anesthetic to relax the muscles around the fracture and to simplify the application of the cast. His type of cast, its method of application, the special head rest, and the exercises during the time of wearing the cast are all held by him to be important modifications of the original Watson Jones method.

Mallet-Guy is particularly concerned with 3 anatomical types of fractures: (1) the severely comminuted, fragmented, dislocated vertebral body; (2) the opposite extreme, the vertebra with a minimal transverse fracture in its interior, without dislocation and without any involvement of the upper or lower meniscal surfaces; and (3) an intermediate type, the most frequent, where the vertebra suffers a fracture with 1 or 2 fragments, and the upper or lower surface of the body is fractured through with partial or complete destruction of the intervertebral disc. The sequelæ of such fractures are pain, deformity through both muscle imbalance and "settling" of the vertebræ because of absorption and osteoporosis in the fractured body, possible secondary neurological lesions, and eventual loss of economic independence of the patient. He believes that the non-operative treatment, requiring the use of a cast no more than 3 or 4 months usually, should be tried before the open operation with laminectomy, grafts, and other radical, often disappointing, methods are used.

It is hardly to be expected that this monograph will be accepted in its entirety by every surgeon whose lot it is to treat spinal fractures. But no one can deny that it is a sincere exposition of the beliefs and experience of a surgeon of repute, that it is written with assuring confidence and a clear understanding of this problem, and that it is free of any extravagant optimism. JOHN MARTIN.

THE new 200 page book, *A Manual of Fractures and Dislocations*,[2] is divided into 4 parts, the first part dealing with definition, classification, and diagnosis of fractures, the second with fractures of the upper extremity, the third with fractures of the trunk, and the fourth part with fractures of the lower extremity. The methods and procedures are fundamentally sound and practical, because they are based on the excellent results of fractures treated on a highly specialized fracture service.

In the first part, the author advises careful history taking and thorough physical examinations. Specific clinical cases are used to emphasize and illustrate important points which are helpful to the reader. The author feels that the choice of the permanent treatment of a fracture should be made when the patient is first seen, and the reduction performed as soon as possible. If operative interference is deemed advisable, it should be performed within the first 10 days. The summary of technique in applying plaster, strapping, and aspirating of joints is well written and illustrated. Throughout the manual there are sketches and diagrams which are clear, exact, and self-explanatory. At the conclusion of each discussion is a summary which includes, very briefly, the treatment, time of immobilization, prognosis, and the salient points presented.

[1] LE TRAITEMENT NON SANGLANT DES FRACTURES DU RACHIS; FRACTURES RÉCENTES—FRACTURES ANCIENNES; TECHNIQUE ET RÉSULTATS. By Pierre Mallet-Guy. Paris: Masson & Cie, 1938.

[2] A MANUAL OF FRACTURES AND DISLOCATIONS. By Barbara Bartlett Stimson, A.B., M.D., Med., Sc.D., F.A.C.S. Philadelphia: Lea & Febiger, 1939.

In fractures of the humeral surgical neck a word of warning is given as to the usual abduction plaster spica which is used. In fracture dislocation of the anatomical neck of the humerus, Dr. Stimson recommends removal of the head. Immediate internal fixation is advised in fractures of the shaft of the humerus. In fractures about the elbow, the important landmarks are well illustrated, and the possibility of growth disturbance is cited, in slipped epiphysis in children suffering from injuries of the elbow. In gross displacement of the radial head, immediate removal is indicated and advised. Kirschner wires are recommended for comminuted fractures of the distal end of the radius. These wires are used for traction above and below the fracture and then incorporated in a circular plaster. In the discussion on hip fractures, the author lists 2 standard methods of treatment, advocating both the Whitman spica and internal fixation, preferably by the use of a Smith-Petersen nail. In most of the fractures of the shaft of the femur in adults, it is felt that some form of skeletal fixation is necessary. In fractures of the tibia and fibula, the use of Kirschner wires is again recommended. Open operation for fractured patella is advised where there exists any separation of the fragments. In this chapter, an excellent and accurate definition and description of a Pott's fracture is given.

The manual is comprehensive, brief, and to the point. No attempt is made to describe surgical technique. The modern methods of treatment of fractures are presented very clearly and definitely. At the beginning of each part of the manual, the incidence of fractures of each bone is carefully tabulated. These statistics are based on 11,000 cases treated at Presbyterian Hospital in New York City between the years 1929 and 1937. This manual is highly recommended for use by the medical student and the general practitioner. FRANK E. STINCHFIELD.

THE title, *Everyday Surgery*,[1] appears to defy the smallness of this book. Turning through its 266 pages one is astonished to find its scope almost comparable to that of the ordinary 1,000 page textbook of surgery. The authors suggest that students, postgraduates, and the isolated practitioner may find practical aid in such a book. No doubt the undergraduate student will enjoy *Everyday Surgery* as it contains a surprising amount of solid material with but very little garnish. However, he will find it in no sense a substitute for the more complete textbooks. The practitioner who turns to it for help in his everyday problems may be disappointed to find that so little space is given to differential diagnosis and treatment, 2 considerations with which he is very much concerned. Failure to mention sulfanilamide in connection with erysipelas and other streptococcal infections is surprising. Only 11 lines are devoted to surgery of the spleen. It seems the authors are too concise in many instances. Exceptions are the chapters dealing with hernia and anorectal diseases. A wealth of information is concentrated into the short chapter on fractures and dislocations. The illustrations are not numerous but usually adequate; most of them appear to be original drawings. Figure 122 will find many criticisers. Dr. Rogers and Dr. d'Abreu state that their objective is an "attempt to present in concise form what we regard as the best in modern surgical practice of an everyday character." In this they have succeeded. If the subject matter is inadequate, this is in some measure compensated for by the excellence of its quality.

W. KENNETH JENNINGS.

[1] EVERYDAY SURGERY. By Lambert Rogers, M.Sc., F.R.C.S., F.R.C.S.E., F.R.A.C.S., F.A.C.S., and A. L. d'Abreu, M.B., Ch.M., F.R.C.S. With an Introduction by Professor G. Grey Turner, D.Ch., M.S., F.R.C.S., F.R.A.C.S., F.A.C.S. Baltimore: William Wood & Co., 1938.

THE English edition of Rouvière's *Anatomy of the Human Lymphatic System*[2] represents "an attempt to make the publication of scholarly and technical books in small editions pay for themselves through the combination of an inexpensive printing process and definite economies of distribution"; the process used is termed "photo-lithograph," which apparently is one of many variations of the general method of offset printing.

In the initial chapter, which concerns the general characteristics of lymphatic vessels, a great deal of valuable information is provided on the direction of lymphatic flow, on the direct emptying of lymphatic vessels into the venous system at points other than the jugulo-subclavian junction, and on the general principles of distribution of lymphatic glands. Beginning with the second chapter, not only are the lymphatics of the larger parts considered (extremities, thoracic, and abdominal parietes, etc.) but also the walls of such smaller spaces as the buccal cavity and larynx, and such specialized structures as the salivary glands, the gums and teeth, the auditory organ, the liver and its biliary passages, and the nervous system.

For each anatomical region the groups of glands are enumerated and the exact location and arrangement of the several sets discussed. Especially serviceable are the notations as to the relation of the glands to neighboring blood vessels, nerves, and fascial layers, and to the surfaces and margins of muscles. The area of origin of the afferent vessels is described in each instance, as is also the course of efferent vessels between groups of glands. The efferents are traced to the larger trunks and ducts. Variations in the number of lymph glands in each group are discussed fully, as are the retrogressive changes which come with advancing age. Inconstant and rare as well as regularly present groups of glands receive attention. The descriptions of the size and form of prominent individual glands are excellent; this constitutes important information for the careful physician, who must know something about quiescent morphology before attempting to judge of pathological enlargement.

[2] ANATOMY OF THE HUMAN LYMPHATIC SYSTEM. By H. Rouvière. A compendium translated from the original *Anatomie des lymphatiques de l'homme* by M. J. Tobias. Ann Arbor, Mich.: Edwards Brothers, Inc., 1938.

The translator, with the commendable purpose of simplifying the original treatment, has removed to a glossary all special material in which the investigator, not the medical student or the practitioner, would be interested; this material alone, of definite value to the research student, covers 27 pages. Available, too, is a superb bibliography of more than 750 titles.

So much, then, for the contents of the volume; but in appraising a book it is essential to distinguish clearly between the products of author and illustrator, and the technical means utilized by printer and engraver in making the scholarly wares vendible. In other words, contents and format are 2 very different things. The format of the present volume, done in modern photo-lithography, is arresting in an unpleasant manner. To one whose interests have taken him through books from the incunabula to those of our own day, this new work arouses a longing for lithographs that deserve the name and for the velvety excellence of the earlier prints. In the volume under discussion, many of the illustrations are so dark that glands and vessels cannot be traced; some schematic ones raise more questions than they answer; some display the topographical features so confusingly as to present a problem in orientation; others are, for the bookmaker's convenience, unfortunately rotated. It is a tribute to our predecessors in the engraving craft that the clearest illustrations in the book are those taken from the works of Mascagni (1823) and Sappey (1874).

The text deserves better handling, even though improvement would necessitate raising the selling price; in anatomy enigmatic figures which do not illustrate are a poor bargain, however low their cost may be.

BARRY ANSON.

BOOKS RECEIVED

Books received are acknowledged in this department, and such acknowledgment must be regarded as a sufficient return for the courtesy of the sender. Selections will be made for review in the interests of our readers and as space permits.

ANNUAL REPRINT OF THE REPORTS OF THE COUNCIL ON PHARMACY AND CHEMISTRY OF THE AMERICAN MEDICAL ASSOCIATION FOR 1938. Chicago: American Medical Association, 1939.

NEW AND NONOFFICIAL REMEDIES, 1939; Containing Descriptions of the Articles Which Stand Accepted by the Council on Pharmacy and Chemistry of the American Medical Association on January 1, 1939. Chicago: American Medical Association, 1939.

THE ROCKEFELLER FOUNDATION ANNUAL REPORT, 1938. New York: The Rockefeller Foundation, 1939.

THE SURGERY OF PAIN. By René Leriche, M.D.(Lyon), LL.D.(Glasgow), F.R.C.S.(Eng.). Translated and edited by Archibald Young, B.Sc., M.B., C.M., F.R.F.P.S.G., F.A.C.S.(Hon.), M.D.(Strasbourg). Baltimore: The Williams & Wilkins Co., 1939.

OPERATIVE ORTHOPEDICS. By Willis C. Campbell, M.D. St. Louis: The C. V. Mosby Co., 1939.

PERIPHERAL VASCULAR DISEASES; DIAGNOSIS AND TREATMENT. By William S. Collens, B.S., M.D., and Nathan D. Wilensky, M.D. Springfield, Ill., and Baltimore, Md.: Charles C. Thomas, 1939.

SURGERY OF THE EYE. By Meyer Wiener, M.D., and Bennett Y. Alvis, M.D. Philadelphia and London: W. B. Saunders Co., 1939.

OXFORD MEDICAL PUBLICATIONS. POST-MORTEM APPEARANCES. By Joan M. Ross, M.D., B.S.(Lond.), M.R.C.S., L.R.C.P. 4th ed. London: Oxford University Press, 1939.

BEESLY AND JOHNSTON'S MANUAL OF SURGICAL ANATOMY. Revised by John Bruce, M.B., F.R.C.S.(Edin.), and Robert Walmsley, M.D. 5th ed. London: Oxford University Press, 1939.

FUNCTIONAL DISORDERS OF THE FOOT; THEIR DIAGNOSIS AND TREATMENT. By Frank D. Dickson, M.D., F.A.C.S., and Rex L. Diveley, A.B., M.D., F.A.C.S. Philadelphia, Montreal, and London: J. B. Lippincott Co., 1939.

THE ART OF ANAESTHESIA. By Paluel J. Flagg, M.D. 6th rev. ed. Philadelphia, London, Montreal: J. B. Lippincott Co., 1939.

LE CANCER DE L'ESTOMAC AU DÉBUT; ÉTUDE CLINIQUE, RADIOLOGIQUE ET ANATOMOPATHOLOGIQUE. By René-A. Gutmann, Ivan Bertrand and Th. J. Péristiany. Preface by Pr. A. Gosset. Paris: G. Doin & Cie, 1939.

THE TISSUES OF THE BODY; AN INTRODUCTION TO THE STUDY OF ANATOMY. By W. E. Le Gros Clark, F.R.S. Oxford: At the Clarendon Press, 1939.

THE STORY OF A BABY. Illustrated by the Author, Marie Hall Ets. New York: The Viking Press, 1939.

SURGICAL APPLIED ANATOMY. By Sir Frederick Treves, Bart. 10th ed., revised by Lambert Rogers, M.Sc., F.R.C.S., F.R.C.S.E., F.R.A.C.S., F.A.C.S. Philadelphia: Lea & Febiger, 1939.

AN INTRODUCTION TO MODERN GENETICS. By C. H. Waddington, Sc.D. New York: The Macmillan Co., 1939.

SCLEROSING THERAPY; THE INJECTION TREATMENT OF HERNIA, HYDROCELE, VARICOSE VEINS AND HEMORRHOIDS. Edited by Frank C. Yeomans, M.D., F.A.C.S., M.R.S.M.(London, Hon.). Baltimore: The Williams & Wilkins Co., 1939.

DISEASES OF THE FOOT. By Emil D. W. Hauser, M.S., M.D. With a Foreword by Sumner L. Koch, M.D. Philadelphia and London: W. B. Saunders Co., 1939.

THE RECTUM AND COLON. By E. Parker Hayden, A.B., M.D., F.A.C.S. Philadelphia: Lea & Febiger, 1939.

NITROUS OXIDE-OXYGEN ANESTHESIA; MCKESSON-CLEMENT VIEWPOINT AND TECHNIQUE. By F. W. Clement, M.D. Philadelphia: Lea & Febiger, 1939.

SYMPOSIUM ON THE SYNAPSE. By Herbert S. Gasser, Joseph Erlanger, Detlev W. Bronk, Rafael Lorente De Nó, and Alexander Forbes. (Reprinted from *Journal of Neurophysiology*, 1939, 2: 361–472.) Springfield, Ill., and Baltimore, Md.: Charles C. Thomas, 1939.

STERILITY AND IMPAIRED FERTILITY; PATHOGENESIS, DIAGNOSIS AND TREATMENT. By Cedric Lane-Roberts, M.S., F.R.C.S., F.R.C.O.G., Albert Sharman, M.D., M.R.C.O.G., Kenneth Walker, F.R.C.S., and B. P. Wiesner, D.Sc., Ph.D., F.R.S.E. With a Foreword by The Rt. Hon. Lord Horder, G.C.V.O., M.D., F.R.C.P. New York: Paul B. Hoeber, Inc., 1939.

UNTOWARD EFFECTS OF NITROUS OXIDE ANESTHESIA; WITH PARTICULAR REFERENCE TO RESIDUAL NEUROLOGIC AND PSYCHIATRIC MANIFESTATIONS. By Cyril B. Courville, M.D. With Foreword by Dr. Yandell Henderson. Mountain View, Calif.: Pacific Press Publishing Ass., 1939.

CLINICAL CONGRESS OF AMERICAN COLLEGE OF SURGEONS

HOWARD C. NAFFZIGER, San Francisco, *President*
GEORGE P. MULLER, Philadelphia, *President-Elect*

Committee on Arrangements
THOMAS A. SHALLOW, *Chairman;* L. KRAEER FERGUSON, *Secretary*

COMPLETE PROGRAM FOR THE 1939 CLINICAL CONGRESS

THE complete program for the twenty-ninth annual Clinical Congress of the American College of Surgeons, to be held in Philadelphia, October 16 to 20, appears in the following pages. The surgeons of Philadelphia, with excellent facilities at their command for clinical demonstration, have arranged a program of operative and non-operative clinics that will be fully worthy of this great medical center with its renowned leaders in medicine and surgery. Five medical schools and more than forty hospitals have co-operated with the committees which have planned the program of clinics and demonstrations which are listed in preliminary form in succeeding pages. The schedules will be revised and enlarged during the weeks preceding the Congress and from day to day thereafter, with daily bulletins being issued at headquarters to show the final schedules. The clinics will be held in the hospitals on Monday afternoon, October 16, and thereafter on both mornings and afternoons of each of the following four days.

Non-operative clinics and symposia, which will supplement the varied and extensive schedule of operative clinics, will show the important work being done in special fields in many of the large hospitals. Participating in some of these discussions will be eminent surgeons from other medical centers who, on invitation from the local clinicians, will describe their own methods and experiences. Among the fields in which demonstrations and exhibits have been arranged will be general surgery, genito-urinary surgery, neurosurgery, fractures and other traumas, obstetrics and gynecology, broncho-esophagology, plastic and faciomaxillary surgery, surgery of the bones and joints, thoracic surgery, ophthalmology, and otorhinolaryngology.

The clinical schedules provided by the hospitals are being so correlated that the visiting surgeon may be assured of an opportunity to devote his time continuously, if he so desires, to clinics dealing with the special subject in which he is most interested. It is planned to provide adequate morning and afternoon programs for general surgery and the various specialties for each day of the Congress.

It should be pointed out that the clinical program as published in the following pages, and also in the official program to be distributed at the Congress, obviously cannot include all of the detailed information regarding operative clinics and demonstrations scheduled for the several hospitals. A complete detailed program will be provided from day to day, posted in the form of bulletins at headquarters each afternoon for the succeeding day and published in the daily *Bulletin* for distribution each morning. Visiting surgeons are urged to consult the bulletins posted at headquarters and the *Daily Clinical Bulletin* in selecting the clinics they wish to attend and in making requisitions for clinic tickets.

Governors and fellows of the College will hold their annual meetings in the Rose Garden of the Bellevue-Stratford Hotel at 1:30 o'clock on Thursday afternoon. At this meeting the officers and chairmen of the standing committees will present reports on activities of the College. Election of officers will follow.

The attention of fellows is especially called to the meeting of three important state and provincial committees to be held on Wednesday in the Palm Garden, on the first floor of the hotel, as follows: Judiciary committees, 9:30 a.m.; Credentials committees, 10 a.m.; Executive committees, 11 a.m. Also of importance is a meeting of the national and regional fracture committees on Thursday afternoon at 4 o'clock in the South Garden.

CLINICAL CONGRESS PROGRAM IN BRIEF

All sessions at the Bellevue-Stratford except as noted.

Monday, October 16

10:00 Hospital Conference—Rose Garden.
11:00 Assembly of Initiates—Palm Garden.
2:00 Clinics in Philadelphia Hospitals.
2:00 Hospital Conference—Rose Garden.
2:00 Surgical Film Exhibition—Palm Garden.
8:00 Presidential Meeting and Convocation—Academy of Music.

Tuesday, October 17

9:00 Clinics in Philadelphia Hospitals.
9:30 Hospital Conference—Rose Garden.
10:00 Clinical Demonstrations, Ophthalmology—North Garden.
10:00 Clinical Demonstrations, Otorhinolaryngology—South Garden.
10:00 Surgical Film Exhibition—Palm Garden.
12:30 Midday Panel Discussions—North Garden, South Garden, Rose Garden, Palm Garden.
2:00 Clinics in Philadelphia Hospitals.
2:00 Hospital Conferences—Rose Garden, South Garden.
2:00 Fracture Symposium—Witherspoon Hall.
2:00 Surgical Film Exhibition—Palm Garden.
8:00 Scientific Session, General Surgery—Irvine Hall.
8:00 Scientific Session, Ophthalmology—North Garden.
8:00 Scientific Session, Otorhinolaryngology—South Garden.
8:00 Hospital Conference—St. Joseph's Hospital.

Wednesday, October 18

9:00 Clinics in Philadelphia Hospitals.
9:30 Hospital Conference—Rose Garden.
9:30 Judiciary Committees—Palm Garden.
10:00 Credentials Committees—Palm Garden.
11:00 Executive Committees—Palm Garden.
10:00 Clinical Demonstrations, Ophthalmology—North Garden.
10:00 Clinical Demonstrations, Otorhinolaryngology—South Garden.
12:30 Midday Panel Discussions—North Garden, South Garden, Rose Garden, Palm Garden.
2:00 Clinics in Philadelphia Hospitals.
2:00 Hospital Demonstrations—Philadelphia Hospitals.
2:00 Symposium on Cancer—Rose Garden.
2:00 Surgical Film Exhibition—Palm Garden.
7:30 Surgical Film Exhibition (ophthalmology and otorhinolaryngology)—Palm Garden.
8:00 Scientific Session, General Surgery—Irvine Hall.

Thursday, October 19

9:00 Clinics in Philadelphia Hospitals.
9:30 Hospital Conference—Rose Garden.
10:00 Clinical Demonstrations, Ophthalmology—North Garden.
10:00 Clinical Demonstrations, Otorhinolaryngology—South Garden.
10:00 Surgical Film Exhibition—Palm Garden.
12:00 Midday Panel Discussions—North Garden, South Garden, Palm Garden.
1:30 Annual Meeting—Rose Garden.
2:00 Clinics in Philadelphia Hospitals.
2:00 Hospital Demonstrations—Philadelphia Hospitals.
3:00 Symposium on Graduate Training—Rose Garden.
3:30 Surgical Film Exhibition—Palm Garden.
4:00 National and Regional Fracture Committees—South Garden.
8:00 Scientific Session, General Surgery—Irvine Hall.
8:00 Scientific Session, Ophthalmology—North Garden.
8:00 Scientific Session, Otorhinolaryngology—Rose Garden.

Friday, October 20

9:00 Clinics in Philadelphia Hospitals.
10:00 Clinical Demonstrations, Ophthalmology—North Garden.
10:00 Clinical Demonstrations, Otorhinolaryngology—South Garden.
10:00 Surgical Film Exhibition—Palm Garden.
12:30 Midday Panel Discussions—North Garden, South Garden, Rose Garden, Palm Garden.
2:00 Symposium on Obstetrics and Gynecology—North Garden.
2:00 Symposium on Urology—South Garden.
2:00 Symposium on Diseases of the Respiratory Tract—Rose Garden.
2:00 Clinics in Philadelphia Hospitals.
2:00 Surgical Film Exhibition—Palm Garden.
8:00 Meeting on Health Conservation—Irvine Hall.

Surgical motion picture films, which so clearly and accurately portray clinical features of major interest to surgeons, will again be shown in wide variety and scope, including the newer methods in operative technique and pre- and postoperative care. There will be an extensive showing of films dealing with subjects related to ophthalmology and otorhinolaryngology. The *Daily Clinical Bulletin* will give the time and place for the showing of these sound and silent films.

SCIENTIFIC SESSIONS

General scientific sessions, in the programs for which the Board of Regents has striven to include newer developments in the general and special surgical fields, will be held on Tuesday, Wednesday, and Thursday evenings in Irvine Hall at the University of Pennsylvania. The subjects to be discussed are listed in the detailed programs which will be found on succeeding pages.

The afternoon symposia have been planned to concentrate attention on specific fields of broad interest. Fractures and other traumas will be discussed at the Tuesday afternoon session. Cancer and some of the many problems related thereto will be discussed in a symposium on Wednesday afternoon, a feature of which will be a presentation by Dr. Bowman C. Crowell, associate director, of the guidance and approval program of the College directed especially toward encouragement of the establishment of cancer clinics in general hospitals. Graduate training for surgery will be the subject of the Thursday afternoon symposium, following the annual meeting. Surgical treatment

of diseases of the respiratory tract will be discussed at one of three separate symposia on Friday afternoon, the other two being urology, and obstetrics and gynecology.

The midday panel discussions include a number of sessions to be held simultaneously, totaling fifteen separate meetings on four successive days, from Tuesday through Friday. The subjects, together with the names of the leaders and collaborators, are listed on a succeeding page. It was necessary to extend these meetings this year because of their demonstrated popularity in the past. The time limit makes concise statement imperative, but nevertheless provides opportunity for a 10-minute outline by the chairman, discussion from at least two viewpoints by selected collaborators, and question and comment from the audience.

Specialists in ophthalmology and otorhinolaryngology, and general surgeons who have an interest in these fields, will be attracted by the programs for the series of four scientific sessions on Tuesday and Thursday evenings. One of the Tuesday evening sessions will present a symposium on the "Surgical Aspects of Detachment of the Retina"; the other a symposium on "Evaluation of Methods of Treatment in Sinusitis." One of the Thursday evening meetings will be devoted to the consideration of various phases of bronchoesophagology, with Dr. Chevalier Jackson as the guest of honor in token of his great achievements in this field.

PRESIDENTIAL MEETING AND CONVOCATION

The usual impressive processional of the officers, regents, and honorary guests will open the combined presidential meeting and convocation of the College to be held in the Academy of Music on Monday evening. Welcome will be extended to the assembly by the chairman of the local Committee on Arrangements, Dr. Thomas A. Shallow. The guests from abroad will be introduced by Dr. Vernon C. David, vice-president. The presidential address will be delivered by Dr. Howard C. Naffziger, the retiring president, and the annual oration on surgery by Dr. Evarts A. Graham. Other features of this meeting will be the inauguration ceremony for the incoming officers, the presentation of the initiates for fellowship, and the awarding of the medical records prize.

ASSEMBLY OF INITIATES

Dr. Howard C. Naffziger, president of the College, will preside over and deliver the opening address at the assembly of the 1939 initiates on Monday morning at 11:00 o'clock in the Palm Garden. Dr. Irvin Abell, vice-chairman of the Board of Regents, and Associate Directors Bowman C. Crowell and Malcolm T. MacEachern will discuss briefly the program of the American College of Surgeons. The initiates will then recite the fellowship pledge, following which they will be greeted by Dr. George P. Muller, president-elect, and Dr. George Crile, chairman of the Board of Regents. The initiates will sign the fellowship roll at the close of the assembly.

OPHTHALMOLOGY AND OTORHINOLARYNGOLOGY

An extensive program of scientific sessions and clinical demonstrations for ophthalmologists and otorhinolaryngologists has been developed. As outlined in the following program, special clinical demonstrations, conducted by local surgeons, will be held at the Bellevue-Stratford on Tuesday, Wednesday, Thursday, and Friday mornings. These sessions, held separately for each group, will cover many of the problems of current interest to those who work in these special fields. In the following pages will be found programs for a series of scientific sessions, to be held at the headquarters hotel on Tuesday and Thursday evenings, for the presentation and discussion of papers. Operative clinics and demonstrations at the hospitals are scheduled for each day as noted in the clinical program.

CLINICAL DEMONSTRATIONS—OTORHINOLARYNGOLOGY

Tuesday, 10:00 a.m.

WILLIAM HEWSON. Operative Indications in Sinusitis.
CARL M. HOUSER. The Use of Sulfapyridine in Lung Abscess Following Tonsillectomy.
HENRY A. MILLER. Treatment of Sinusitis in Children.
THOMAS F. GOWEN. Management of Nasopharyngeal Fibromas.

Wednesday, 10:00 a.m.

ROBERT H. IVY. Pathological Conditions of the Mouth.
GABRIEL TUCKER. Diagnosis and Treatment of Laryngeal Tumors, Benign and Malignant (color motion picture).
CHEVALIER L. JACKSON. Bronchoscopic Aspects of Bronchial and Pulmonary Tumors.
LOUIS H. CLERF. Pathological Conditions of the Esophagus.

Thursday, 10:00 a.m.

Symposium on Chronic Progressive Deafness.
OSCAR V. BATSON. Anatomy and Physiology of the Ear.
HARRY P. SCHENCK. Thyroxin in the Treatment of Deafness and Tinnitus.
WALTER HUGHSON. Surgical Treatment (round window grafts).
EDWARD H. CAMPBELL. Surgical Treatment (labyrinth fistulization).

Friday, 10:00 a.m.

F. HAROLD KRAUSS. Diagnosis of Lateral Sinus Thrombosis (report of cases).
HOWARD M. HEBBLE. Treatment of Otitis Media and Mastoiditis of Infants and Children with Sulfanilamide.

HARRISON F. FLIPPIN. Treatment of Pneumococcus Meningitis with Sulfapyridine.

IRVING J. WOLMAN. Congenital Stenosis of the Trachea (report of a case).

OPHTHALMOLOGY

Tuesday, 10:00 a.m.

ROBB MCDONALD. Dark Adaptation.

Wednesday, 10:00 a.m.

WALTER I. LILLIE. Fundus Changes Associated with Neurosurgical Conditions.

Thursday, 10:00 a.m.

E. B. SPAETH. Bilateral Congenital Colobomas, Inner Angle of Lower Lids, in a Sister and Brother.

Friday, 10:00 a.m.

I. S. TASSMAN. Use of Contact Lenses, Telescopic Spectacles and Other Aids in Cases of Greatly Reduced Vision.

GRADUATE TRAINING FOR SURGERY

A symposium on "Graduate Training for Surgery" will be held at 3 o'clock Thursday afternoon following the annual meeting of the fellows. The program of guidance which the American College of Surgeons has instituted in this field will be discussed by Dr. Dallas B. Phemister, of Chicago, chairman of the committee under whose sponsorship it has been carried forward. This program has been motivated by the original and primary purpose of the College to elevate the standards of the profession, and knowledge of the progress which has been made will be gratifying to the entire fellowship. As a result of personal surveys begun in January, 1937, by the field staff of the College, information was collected on which to base criteria for evaluating the plans contemplated or already in effect in hospitals. As the surveys have continued, the criteria have been applied as a basis for approval, and an approved list of hospitals for graduate training in general surgery and the surgical specialties in the United States and Canada was published in the January, 1939, *Bulletin*, republished with revisions in April, and will appear with further revisions in the October issue.

There have also been published in the *Bulletin* since September, 1938, descriptions of graduate training plans in effect in 43 hospitals, groups of hospitals, or medical schools which correlate their graduate training programs with clinical facilities provided in hospitals. These furnish specific details in actual situations which show how the criteria are applied under widely different conditions. In the symposium on graduate training at the Clinical Congress more information will be furnished on how acceptable programs may be developed.

The organization of an educational program will be described by Dr. Willis D. Gatch, of Indianapolis. Ensuing discussion of this topic will be led by Dr. George J. Heuer, of New York. Supervision of the educational program will be described by Dr. Waltman Walters, of Rochester, and the discussion which will follow will be led by Dr. Alton Ochsner, of New Orleans. Three different phases of basic science requirements—the basic course, research, and organized study of surgical pathology—will be discussed by Dr. Walter Estell Lee, of Philadelphia, Dr. Alexander Brunschwig, of Chicago, and Dr. Carl H. Lenhart, of Cleveland, respectively, followed by general discussion to be led by Dr. Howard C. Naffziger, of San Francisco. Dr. Walter D. Wise and Dr. Henry F. Bongardt, of Baltimore, will tell how to evaluate graduate training through records, reports, and estimates of work. General discussion of this subject will be led by Dr. Donald Guthrie, of Sayre, Pa.

All fellows of the College should take advantage of the opportunity afforded by this meeting to obtain and exchange information on this most timely subject. An increasing proportion of the fellowship will, as the program advances, be directly charged with the supervision, preceptorship, and guided instruction which must be systematically developed and carried on in hospitals which undertake graduate training for surgery.

HOSPITAL CONFERENCE

The twenty-second annual Hospital Standardization Conference will offer the usual full program embracing a wide range of topics related to the hospital care of the patient. Those who attended the conference in the same city three years ago will recall the inspiration furnished by the privilege of inspecting the facilities of one of the country's great hospital centers, numbering among its institutions the oldest hospital in the United States, which is still in existence, and will want to renew the experience and observe the progress that has been made in the meantime. Those who have not had the privilege of visiting Philadelphia hospitals before have a memorable experience in store for them. During the four day conference ample opportunity will be provided for independent visits to hospitals, in addition to attendance at the special demonstrations which have been arranged for Wednesday and Thursday afternoons. The latter will include a wide variety of procedures and techniques, as will be noted from the detailed program which appears on a succeeding page.

The first event on the program for the Hospital

Conference will be an address on "The Hospital Program of the American College of Surgeons," by Dr. Howard C. Naffziger, of San Francisco, president of the College, at 10 a.m. on Monday in the Rose Garden of the Bellevue-Stratford Hotel. Official announcement by Dr. George Crile, chairman of the Board of Regents, of the 1939 list of approved hospitals in the United States and Canada will follow. At this session two speakers will discuss the important current topic of graduate training for general surgery and the surgical specialties. Dr. Dallas B. Phemister, of Chicago, chairman of the American College of Surgeons Committee on Graduate Training for Surgery, will outline trends in this field, and Dr. Robin C. Buerki, of Chicago, director of study for the Commission on Graduate Medical Education, will discuss "The Rôle of the Hospital in Graduate Education for the Physician or Surgeon Desirous of Proper Preparation for His Specialty." Other educational aspects of hospital service will be covered by Dr. Fred G. Carter, of Cleveland, president of the American Hospital Association, whose subject will be "Educated and Trained Personnel Essential for Maintaining Proper Standards of Service in the Care of the Patient," and by James A. Hamilton, of New Haven, Conn., president of the American College of Hospital Administrators, who will outline the "Essential Qualifications of an Efficient Hospital Administrator." Another topic of absorbing interest, which will be discussed at this session by an able and venerated speaker, will be "The Preservation of Our Present Voluntary Hospital System," by Rev. A. M. Schwitalla, S.J., of St. Louis, president of the Catholic Hospital Association and dean of St. Louis University School of Medicine. At the conclusion of the formal discussions, the meeting will be thrown open for questions and comment under the leadership of Dr. George P. Muller, of Philadelphia, president-elect of the American College of Surgeons.

Study of the detailed program for the remainder of the conference, which appears in the following pages, will reveal how much there is in it of potential interest and profit, on subjects of both general and special concern, for members of medical staffs of hospitals, trustees, administrators, and other executive personnel. At some of the sessions, such as those on Monday afternoon and on Thursday morning, a miscellany of topics will be discussed. At others a more limited field will be covered. The Tuesday morning session, for instance, will be given over to a discussion of "The Medical Staff; Its Organization and Function." The subject will first be presented in general outline; then four speakers will discuss it from certain angles, such as, what actually constitutes a medical staff, proper procedures in extending hospital privileges, making appointments to the medical staff, selection and appointment of chief of medical staff and heads of clinical departments. Control of clinical work through an accounting of professional services will be a final special topic of discussion at this session.

Another special session will be devoted to the general theme, "The Organization and Management of the Small Hospital." This will be held on Tuesday afternoon in the form of a panel round table conference. The standpoints of the importance of the small hospital in certain communities, maintaining competent personnel, medical staff organization, medical records, clinical laboratory and x-ray services, nursing, and financing, will be discussed by various speakers. The importance of all small hospitals meeting the minimum requirements of the College will be emphasized.

On Tuesday afternoon, panel discussions on problems pertaining to various phases of hospital administration in the large hospital will be held separately. Among the topics to be presented from this viewpoint will be administrative practices, accounting control and hospital costs, anesthesia, care of emergencies, control of postoperative infections from the viewpoints of surgical instruments, hospitalization, and compensation charges.

An evening session on Tuesday, in the auditorium of St. Joseph's Hospital, is expected to attract a large audience. This will be a round table conference for the discussion of pertinent problems submitted by hospital executives, and will be conducted by Carl I. Flath, of Toronto, and Dr. Malcolm T. MacEachern, of Chicago.

The joint conference of the American College of Surgeons and the American Association of Medical Record Librarians is always an important event on the hospital conference program. It will be held on Wednesday morning at the headquarters hotel under the chairmanship of Dr. Robin C. Buerki. A review of the present status of medical records in the United States and Canada will be presented by Dr. E. W. Williamson, assistant director of the American College of Surgeons. The president of the Association, Lillian H. Erickson, of Chicago, will discuss "The Present Status of the Training of Medical Record Librarians," and other speakers will present various aspects of medical record keeping and utilization. A round table conference on "Medical Record Problems" will conclude the session.

Every year a number of new developments in the mechanical equipment, the professional methods, and the psychological and public relations aspects of hospitals arise. The hospital executive who attends the Hospital Standardization Conference will find the developments of the past year, together with those which have gone before and are still accepted, graphically portrayed in the exhibits and motion pictures of interest to hospital people, and clearly described in the talks and discussions at the formal sessions, panel discussions, round table conferences, and hospital demonstrations. A stimulating series of meetings is assured, and to every hospital is extended an invitation to be well represented at the conference.

ADVANCE REGISTRATION

The hospitals and medical schools of the Philadelphia area afford accommodations for large numbers of visiting surgeons, but to insure against overcrowding, attendance at the Congress will be limited to the number that can be comfortably accommodated at the clinics. The limit of attendance will be based upon the results of a survey of the operating rooms and laboratories of the hospitals and medical schools to determine their capacity for visitors. It is expected, therefore, that those surgeons who wish to attend the Congress will register in advance. A registration fee will be required in order to provide funds with which to meet the expenses of the Congress. A formal receipt will be issued to each surgeon registering in advance which is to be exchanged for a general admission card upon his registration at headquarters during the Congress. This card, which is not transferable, must be presented to secure clinic tickets and admission to scientific sessions.

A resolution adopted by the Board of Regents provides that the registration fee for fellows and endorsed junior candidates shall be $5.00; that no fee for the 1939 Congress shall be required of initiates (class of 1939); that the fee for nonfellows attending as invited guests of the College will be $10.00.

As in previous years, admission to clinics and demonstrations at the hospitals will be controlled by means of clinic tickets, which plan provides an efficient means for the distribution of visiting surgeons at the various clinics and assures against overcrowding. The number of tickets issued for any clinic will be limited to the capacity of the room in which the presentation is held.

HEADQUARTERS—TECHNICAL EXHIBITION

Headquarters for the Congress will be established at the Bellevue-Stratford Hotel where there are unusual facilities for accommodating the Congress. The Ballroom, Palm Garden, Clover and Red rooms and other large rooms on the first and second floors and the roof have been reserved for scientific exhibits and conferences, registration, clinic ticket bureaus, bulletin boards, executive offices, etc. Thus, the activities of the Congress will be centralized under one roof.

The Technical Exhibition will be located in the Ballroom and adjacent rooms on the second floor. The registration and clinic ticket bureaus, together with the registration desk, will be centrally located on that floor. The bulletin boards, on which the daily clinical programs will be posted each afternoon, will be distributed through the exhibit rooms. Leading manufacturers of surgical instruments and supplies, x-ray equipment, operating room lights, hospital apparatus of all kinds, ligatures, dressings, pharmaceuticals, and publishers of medical books will be represented.

PHILADELPHIA HOTELS AND THEIR RATES

In addition to the headquarters hotel, the Bellevue-Stratford, there are many first-class hotels within a short walking distance, providing ample hotel facilities at reasonable rates. It is suggested that reservation of hotel accommodations be made at an early date at the following hotels which are recommended by the committee:

	Minimum rate with bath	
	Single	Double
Adelphia, 13th and Chestnut Sts	$3.85	$5.50
Barclay, Rittenhouse Square, E	4.50	7.00
Bellevue-Stratford, Broad and Walnut Sts	3.85	5.50
Benjamin Franklin, 9th and Chestnut Sts	3.85	5.50
Colonial, 11th and Spruce Sts	2.50	3.85
Drake, 1512 Spruce St	4.00	6.00
Majestic, Broad St. and Girard Ave	2.50	4.00
Philadelphian, 39th and Chestnut Sts	2.75	4.40
Ritz Carlton, Broad and Walnut Sts	3.50	6.00
Robert Morris, 17th and Arch Sts	2.50	3.50
Spruce, 13th and Spruce Sts	1.50	2.50
St. James, 13th and Walnut Sts	2.75	4.50
Sylvania, Juniper and Locust Sts	3.00	5.00
Walton, Broad and Locust Sts	2.50	4.00
Warwick, 17th and Locust Sts	4.50	7.00
Wellington, 19th and Walnut Sts	4.00	6.00

RAILROAD FARES

No special rates have been authorized by the railroads for the 1939 Clinical Congress in Philadelphia, in accordance with the policy adopted by the railroads of the United States and Canada, so that certificates will not be required. However, round trip tickets to be sold at less than regular fares will be available from all parts of the United States and Canada, except in the New England states, where regular rates will be in effect. Return limit provisions are not uniform as to all sections

of the country, but in no case are they less than 30 days. It is suggested to surgeons planning to attend the Congress that they consult local ticket agents some days in advance of the date of the meeting for complete information as to fares, routes and stopover privileges.

SPECIAL TRAIN FROM CHICAGO TO PHILADELPHIA

For the convenience of the fellows living in the central and western states who will attend the Congress in Philadelphia, arrangements have been made with the Pennsylvania Railroad to provide a special train leaving Chicago from the Union Station (Adams, Jackson and Canal Streets), at 3:30 p.m. (C.S.T.) on Sunday, October 15, to arrive in Philadelphia at 8 a.m. (E.S.T.) on Monday. The special train will be composed of air conditioned cars of latest design, including club, lounge, observation, compartment, bedroom, standard sleeping and dining cars. No extra fare will be charged.

Round trip tickets from Chicago to New York, on account of the World's Fair, with stopover at Philadelphia and a 60-day return limit, will be available at special rates.

Fellows are urged to make their reservations for this special train at the earliest possible date, making application to Mr. W. E. Millspaugh, passenger representative of the Pennsylvania Railroad, Room 1027, 33 N. LaSalle Street, Chicago.

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St. Joseph's—Verne G. Burden.
St. Luke's and Children's—Desiderio Roman.
St. Mary's—James A. Kelly.
St. Vincent's—William F. Morrison.
Shriner's—John R. Moore.
Stetson—Robert S. Alston.
Temple University—W. Wayne Babcock, Walter I. Lillie, Robert F. Ridpath.
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West Jersey Homeopathic (Camden, N. J.)—E. S. Hallinger.
Wills—Warren S. Reese.
Woman's—Margaret Sturgis.
Woman's Medical College—Faith S. Fetterman, James A. Lehman.
Women's Homeopathic—Francois L. Hughes.

PROGRAMS FOR EVENING SESSIONS

Presidential Meeting and Convocation—Monday, 8:00 p.m.—Academy of Music

Processional—Officers, Regents, and Honorary Guests.
Invocation.
Address of Welcome. THOMAS A. SHALLOW, M.D., Philadelphia, Chairman, Committee on Arrangements.
Introduction of Foreign Guests. VERNON C. DAVID, M.D., Chicago, Vice-President.
Address of Retiring President. HOWARD C. NAFFZIGER, M.D., San Francisco.
Inauguration of Officers. Presented by FRASER B. GURD, M.D., Montreal, Vice-President.
President: GEORGE P. MULLER, M.D., Philadelphia
First Vice-President: HENRY W. CAVE, M.D., New York
Second Vice-President: D. EDWIN ROBERTSON, M.D., Toronto
Presentation of Initiates for Fellowship. GEORGE CRILE, M.D., Cleveland, Chairman, Board of Regents.
Conferring of Fellowships by the President. GEORGE P. MULLER, M.D., Philadelphia.
Conferring of Honorary Fellowships. The President.
Medical Records Prize Award. Presented by J. BENTLEY SQUIER, M.D., New York, on behalf of SURGERY, GYNECOLOGY AND OBSTETRICS.
Annual Oration on Surgery: Intrathoracic Tumors. EVARTS A. GRAHAM, M.D., St. Louis.

Tuesday, 8:00 p.m.—Irvine Hall

The Essential Principles in Clean Wound Healing. ALLEN O. WHIPPLE, M.D., New York.
Control of Hemorrhagic Tendencies, Including Physiology and Chemistry. WALTMAN WALTERS, M.D., Rochester, Minn.
Water and Salt Requirements in the Postoperative Case. FREDERICK A. COLLER, M.D., Ann Arbor, Mich.
Vitamin and Protein Factors in the Pre-operative and Postoperative Care of Surgical Patients. EMILE HOLMAN, M.D., San Francisco.

Wednesday, 8:00 p.m.—Irvine Hall

Decompression in the Treatment of Intestinal Obstruction. CHARLES G. JOHNSTON, M.D., Detroit.
Management of Chronic Pelvic Infections. GEORGE H. GARDNER, M.D., Chicago.
Conservative Surgery of Bone Tumors. DALLAS B. PHEMISTER, M.D., Chicago.
Fracture Oration: The Ambulatory Treatment of Fractures of the Lower Extremity. FRASER B. GURD, M.D., Montreal.

Thursday, 8:00 p.m.—Irvine Hall

The Re-establishment of the Gastric Passage after Resection. PROF. DR. JENO POLYA, Budapest, Hungary.
Duplications of the Alimentary Tract. WILLIAM E. LADD, M.D., Boston.
Evaluation of Current Methods in the Management of Peptic Ulcer. VERNE C. HUNT, M.D., Los Angeles.
Operability and Factors which Increase Curability of Malignancy of the Colon and Rectum. THOMAS E. JONES, M.D., Cleveland.

ASSEMBLY OF INITIATES

Monday, 11:00 a.m.—Palm Garden, Bellevue-Stratford Hotel

Opening Remarks. HOWARD C. NAFFZIGER, M.D., San Francisco, President.
The Program of the American College of Surgeons:
IRVIN ABELL, M.D., Louisville, Vice-Chairman, Board of Regents.
BOWMAN C. CROWELL, M.D., Chicago, Associate Director.
MALCOLM T. MACEACHERN, M.D., Chicago, Associate Director.
The Fellowship Pledge. Recital by Initiates.
Greetings to the Initiates. GEORGE P. MULLER, M.D., Philadelphia, President-elect.
Closing Remarks. GEORGE CRILE, M.D., Cleveland, Chairman, Board of Regents.
Signing of the Fellowship Roll. The Initiates.

PROGRAMS FOR EVENING SESSIONS

OPHTHALMOLOGY

Tuesday, 8:00 p.m.—North Garden, Bellevue-Stratford Hotel

Symposium: Surgical Aspect of Detachment of the Retina

Results of Operations at the Mayo Clinic. WILLIAM L. BENEDICT, M.D., Rochester, Minn.

Results of Operations at the New York Eye and Ear Infirmary. CONRAD BERENS, M.D., New York.

Results of Operations at the Memphis Eye, Ear, Nose, and Throat Hospital. EDWARD C. ELLETT, M.D., Memphis, Tenn.

Results of Operations at the Illinois Eye and Ear Infirmary. SAMUEL J. MEYER, M.D., Chicago.

Results of Operations at the Washington University School of Medicine. LAWRENCE T. POST, M.D., and THEODORE E. SANDERS, M.D., St. Louis.

General Discussion.

Thursday, 8.00 p.m.—North Garden, Bellevue-Stratford Hotel

Recent Advances in Plastic Surgery about the Eyes (Technique). VILRAY P. BLAIR, M.D., St. Louis.

The Technique of Correction of Blepharoptosis. DANIEL B. KIRBY, M.D., New York.

General Discussion.

OTORHINOLARYNGOLOGY

Tuesday, 8.00 p.m.—South Garden, Bellevue-Stratford Hotel

Symposium: Evaluation of Methods of Treatment in Sinusitis

The Indications for Surgical Treatment in Sinusitis. FREDERICK T. HILL, M.D., Waterville, Maine.

The Diagnosis and Surgical Management of Chronic Sinusitis. W. RAYMOND MCKENZIE, M.D., Baltimore.

How and When Shall We Operate upon the Ethmoid Sinuses? WILLIAM MITHOEFER, M.D., Cincinnati.

Non-surgical Therapy in Acute Sinus Disease. HENRY B. ORTON, M.D., Newark.

General Discussion.

Thursday 8.00 p.m.—Rose Garden, Bellevue-Stratford Hotel

CHEVALIER JACKSON, M.D., Philadelphia, Honor Guest

GEORGE P. MULLER, M.D., Philadelphia, President, American College of Surgeons, Presiding

Introductory Remarks. GEORGE P. MULLER, M.D., Philadelphia.

Response. CHEVALIER JACKSON, M.D., Philadelphia.

Present Trends in the Technique of Laryngectomy. CHEVALIER JACKSON, M.D., Philadelphia.

Foreign Bodies in the Air and Food Passages (Observations on End Results in a Series of Nine Hundred Fifty Cases). LOUIS H. CLERF, M.D., Philadelphia.

Laryngofissure after the Technique of Chevalier Jackson (Observations on Technique and Results in a Series of Over One Hundred Cases). GABRIEL TUCKER, M.D., Philadelphia.

The Development of Broncho-Esophagology. CHARLES J. IMPERATORI, M.D., New York.

The Voice after Laryngeal Operations. CHEVALIER L. JACKSON, M.D., Philadelphia.

MEETING ON HEALTH CONSERVATION

Friday, 8:00 p.m.—Irvine Hall

GEORGE P. MULLER, M.D., Philadelphia; President, American College of Surgeons, Presiding.

Surgery—Yesterday and Today. GEORGE CRILE, M.D., Cleveland; Chairman, Board of Regents.

Medical Science Marches On. IRVIN ABELL, M.D., Louisville; Vice-Chairman, Board of Regents.

Progress in the Control and Treatment of Cancer. JAMES EWING, M.D., New York.

An Inventory of Your Health. FRANK H. LAHEY, M.D., Boston.

Maternal Welfare. JOHN R. FRASER, M.D., Montreal.

Hospitals Today. MALCOLM T. MACEACHERN, M.D., Chicago, Associate Director.

PROGRAMS FOR AFTERNOON SESSIONS

SYMPOSIUM ON FRACTURES AND OTHER TRAUMAS

Tuesday, 2.00 p.m.—Witherspoon Hall

ROBERT H. KENNEDY, M.D., New York, Chairman, Committee on Fractures and Other Traumas, Presiding.

An Impartial Evaluation of Several Standard Operations for Hip Reconstruction. OTTO J. HERMANN, M.D. Boston.

Chest Injuries. FRANK B. BERRY, M.D., New York.

The Use of Hanging Casts for Fractures of the Shaft of the Humerus. JOHN A. CALDWELL, M.D., Cincinnati.

Evaluation of the Traction Treatment of Fractures of the Os Calcis. JOHN DUNLOP, M.D., Pasadena.

Primary and Secondary Tendon Suture. MICHAEL L. MASON, M.D., Chicago.

SYMPOSIUM ON CANCER

Wednesday, 2.00 p.m.—Rose Garden, Bellevue-Stratford Hotel

FRANK E. ADAIR, M.D., New York, Chairman, Cancer Committee, Presiding.

Radiological Treatment of Cancer of Tongue. HAYES E. MARTIN, M.D., New York.

Surgical Treatment of Cancer of Tongue. LELAND R. COWAN, M.D., Salt Lake City.

Surgical Treatment of Cancer of the Thoracic Esophagus. JOHN H. GARLOCK, M.D., New York.

What Constitutes Malignant Tumors of the Nervous System and How to Deal with Them. ERNEST SACHS, M.D., St. Louis.

Cancer Clinics. BOWMAN C. CROWELL, M.D., Chicago.

Survival Statistics, Cancer of the Breast, 1925–1935, Jefferson Hospital. WILLIAM H. KRAEMER, M.D., Philadelphia.

SYMPOSIUM ON GRADUATE TRAINING FOR SURGERY

Thursday, 3:00 p.m.—Rose Garden, Bellevue-Stratford Hotel

DALLAS B. PHEMISTER, M.D., Chicago; Chairman, Committee on Graduate Training for Surgery, Presiding.

Organizing an Educational Program. WILLIS D. GATCH, M.D., Indianapolis.
Discussion by GEORGE J. HEUER, M.D., New York.

Supervision of the Educational Program. WALTMAN WALTERS, M.D., Rochester, Minn.
Discussion by ALTON OCHSNER, M.D., New Orleans.

Basic Science Requirements:
Basic Course. WALTER ESTELL LEE, M.D., Philadelphia.
Research. ALEXANDER BRUNSCHWIG, M.D., Chicago.
Organized Study of Surgical Pathology. CARL H. LENHART, M.D., Cleveland.
Discussion by HOWARD C. NAFFZIGER, M.D., San Francisco.

Evaluation of Graduate Training—Records, Reports, and Estimates of Work.
WALTER D. WISE, M.D., and HENRY F. BONGARDT, M.D., Baltimore.
Discussion by DONALD GUTHRIE, M.D., Sayre, Pa.

SYMPOSIUM ON UROLOGY

Friday, 2:00 p.m.—South Garden, Bellevue-Stratford Hotel

End Results in Carcinoma of the Bladder Treated by Radium. BENJAMIN S. BARRINGER, M.D., New York.

Urologic Aspects of Hypertension. DAVID W. MACKENZIE, M.D., Montreal.

Perirenal Infections. HOMER G. HAMER, M.D., Indianapolis.

Some Complications and Dangers of the Lower Ureteral Calculus. JOHN K. ORMOND, M.D., Detroit.

The Development of Prostatic Hyperplasias. CLYDE L. DEMING, M.D., New Haven.

SYMPOSIUM ON THE SURGICAL TREATMENT OF DISEASES OF THE RESPIRATORY TRACT

Friday, 2:00 p.m.—Rose Garden, Bellevue-Stratford Hotel

Principles in the Treatment of Empyema. WILLARD VAN HAZEL, M.D., Chicago.

Relationship of Bronchoscopy to Surgery of the Respiratory Tract. JOHN D. KERNAN, M.D., New York.

Surgical Treatment of Pulmonary Abscess. GEORGE J. HEUER, M.D., New York.

Curability of Primary Carcinoma of the Lung; Early Recognition and Management. RICHARD H. OVERHOLT, M.D., Boston.

Postoperative Pulmonary Complications. DANIEL C. ELKIN, M.D., Atlanta.

SYMPOSIUM ON OBSTETRICS AND GYNECOLOGY

Friday, 2:00 p.m.—North Garden, Bellevue-Stratford Hotel

Some Complications of Pregnancy in which Cesarean Section Is Indicated. ARTHUR H. BILL, M.D., Cleveland.

The Management of Dystocias of Pregnancy. ALFRED C. BECK, M.D., Brooklyn.

Toxemias of Pregnancy. HERMAN W. JOHNSON, M.D., Houston, Texas.

Prophylaxis and Treatment of Carcinoma of the Cervix and Body of the Uterus. WILLARD R. COOKE, M.D., Galveston, Texas.

Endocrine Therapy in Obstetrics and Gynecology. JOHN C. BURCH, M.D., Nashville, Tenn.

MIDDAY PANEL DISCUSSIONS

Tuesday, 12:30 to 1:45 p.m.—Bellevue-Stratford Hotel

Rose Garden

Delayed Union and Non-Union of Fractures. HENRY C. MARBLE, M.D., Boston, Presiding.

Collaborators: R. ARNOLD GRISWOLD, M.D., Louisville; CLAY RAY MURRAY, M.D., New York.

South Garden

Brain Abscess. CHARLES BAGLEY, JR., M.D., Baltimore, Presiding.

Collaborators: C. C. COLEMAN, M.D., Richmond; FRANCIS C. GRANT, M.D., Philadelphia; JOSEPH E. J. KING, M.D., New York.

Palm Garden

Sterilization and Aseptic Operating Room Technique. ELLIOTT C. CUTLER, M.D., Boston, Presiding.

Collaborators: J. DERYL HART, M.D., Durham, N.C.; FRANK L. MELENEY, M.D., New York.

North Garden

Pre- and Postoperative Drugs Used in Gastro-intestinal Surgery. IDYS MIMS GAGE, M.D., New Orleans, Presiding.

Collaborators: ROY D. MCCLURE, M.D., Detroit; CHARLES B. PUESTOW, M.D., Chicago; RALPH M. WATERS, M.D., Madison, Wis.

Wednesday, 12:30 to 1:45 p.m.—Bellevue-Stratford Hotel

Rose Garden

Biliary Tract Surgery and the Bad Risk Case. ARTHUR W. ALLEN, M.D., Boston, Presiding.

Collaborators: FREDERICK S. FOOTE, M.D., San Francisco; CHARLES G. JOHNSTON, M.D., Detroit; I. S. RAVDIN, M.D., Philadelphia; WALTER D. WISE, M.D., Baltimore.

South Garden

Treatment of Varicose Veins. H. O. MCPHEETERS, M.D., Minneapolis, Presiding.

Collaborators: BEVERLY DOUGLAS, M.D., Nashville; HENRY H. FAXON, M.D., Boston; ALTON OCHSNER, M.D., New Orleans; HUGH H. TROUT, M.D., Roanoke.

North Garden

Vitamins and Surgery. CHARLES B. PUESTOW, M.D., Chicago, Presiding.

Collaborators: ALFRED BLALOCK, M.D., Nashville; CHARLES W. MAYO, M.D., Rochester, Minn.

Palm Garden

Some Factors in Blood Preservation. JOHN SCUDDER, M.D., New York, Presiding.

Collaborators: WILLIAM E. STUDDIFORD, M.D., New York; ELIZABETH H. SCHIRMER, M.D., Chicago; L. KRAEER FERGUSON, M.D., Philadelphia.

Thursday, 12:00 m. to 1:15 p.m.—Bellevue-Stratford Hotel

North Garden

Ulcerative Colitis. HENRY W. CAVE, M.D., New York, Presiding.

Collaborators: RICHARD B. CATTELL, M.D., Boston; THOMAS T. MACKIE, M.D., New York; HARVEY B. STONE, M.D., Baltimore.

South Garden

The Recognition and Management of Hyperthyroidism. GEORGE M. CURTIS, M.D., Columbus, Ohio Presiding.

Collaborators: ROY D. MCCLURE, M.D., Detroit; WARREN H. COLE, M.D., Chicago; HAROLD L. FOSS, M.D., Danville, Pa.; S. L. LEDBETTER, M.D., Birmingham.

Palm Garden

Postoperative Wound Disruption. ARTHUR M. SHIPLEY, M.D., Baltimore, Presiding.

Collaborators: L. S. FALLIS, M.D., Detroit; HILGER PERRY JENKINS, M.D., Chicago; URBAN MAES, M.D., New Orleans.

Friday, 12:30 to 1:45 p.m.—Bellevue-Stratford Hotel

Rose Garden

Analgesia and Anesthesia in Obstetrics. HOWARD F. KANE, M.D., Washington, Presiding.

Collaborators: ARTHUR H. BILL, M.D., Cleveland; THADDEUS L. MONTGOMERY, M.D., Philadelphia.

Palm Garden

Postoperative Infections. FRANK L. MELENEY, M.D., New York, Presiding.

Collaborators: MARTIN B. TINKER, M.D., Ithaca; CORNELIUS J. KRAISSL, M.D., New York; JOHN STAIGE DAVIS, M.D., Baltimore; CHAMP LYONS, M.D., Boston; JOHN S. LOCKWOOD, M.D., Philadelphia.

North Garden

The Management of Cleft Lip and Cleft Palate. GEORGE WARREN PIERCE, M.D., San Francisco, Presiding.

Collaborators: VILRAY P. BLAIR, M.D., St. Louis; V. H. KAZANJIAN, M.D., Boston; EARL C. PADGETT, M.D., Kansas City, Mo.; H. L. D. KIRKHAM, M.D., Houston, Texas.

South Garden

Indications for Surgical Treatment of Renal Tuberculosis. GILBERT J. THOMAS, M.D., Minneapolis, Presiding.

Collaborators: HENRY O. MERTZ, M.D., Indianapolis; ALEXANDER RANDALL, M.D., Philadelphia; WILLIAM H. TOULSON, M.D., Baltimore.

ANNUAL HOSPITAL STANDARDIZATION CONFERENCE

Monday, 10:00—Rose Garden, Bellevue-Stratford Hotel

HOWARD C. NAFFZIGER, M.D., San Francisco; President American College of Surgeons, presiding.

Address of President—The Hospital Program of the American College of Surgeons.

The 1939 Hospital Standardization Survey—Official Announcement of the List of Approved Hospitals. GEORGE CRILE, M.D., Cleveland; Chairman, Board of Regents.

Trends in Graduate Training for Surgery and the Surgical Specialties as Related to Hospitals. DALLAS B. PHEMISTER, M.D., Chicago.

The Preservation of Our Present Voluntary Hospital System. REV. A. M. SCHWITALLA, S.J., St. Louis.

Educated and Trained Personnel Essential for Maintaining Proper Standards of Service in the Care of the Patient. FRED G. CARTER, M.D., Cleveland.

The Rôle of the Hospital in Graduate Education for the Physician or Surgeon Desirous of Proper Preparation for his Specialty. ROBIN C. BUERKI, M.D., Chicago.

Essential Qualifications of an Efficient Hospital Administrator. JAMES A. HAMILTON, New Haven, Conn.

General Discussion. Opened by GEORGE P. MULLER, M.D., Philadelphia.

Monday, 2:00—Rose Garden, Bellevue-Stratford Hotel

FRASER B. GURD, M.D., Montreal, Vice President, American College of Surgeons, presiding.

Opening Remarks—Hospital Standardization in Canada. FRASER B. GURD, M.D., Montreal.

The Hospital Trustee and His Proper Conception of Administrative and Professional Practices. RAYMOND P. SLOAN, New York.

Responsibility of Elected Public Officials in the Care of the Indigent Sick. CLIFFORD CORNELI, Clayton, Mo.

A Study of Nursing Hours in the Care of Various Types of Patients. ALBERT H. SCHEIDT, Chicago.

The Significance of Research and Statistics in the Hospital Field. ARNOLD F. EMCH, Ph.D., Chicago.

Relation of Dietary Deficiencies to Surgical Convalescence. CHARLES B. PUESTOW, M.D., Chicago.

Criteria for an Efficient Graduate Nursing Service, with Special Reference to Administrative Policies of the Hospital. ALMA H. SCOTT, R.N., New York.

General Discussion. Opened by LEWIS E. JARRETT, M.D., Richmond, Va.

Tuesday, 9:30—Rose Garden, Bellevue-Stratford Hotel

CLAUDE W. MUNGER, M.D., New York, presiding.

General Theme: The Medical Staff, Its Organization and Function.

The Importance of an Efficient Medical Staff to a Hospital. EUGENE WALKER, M.D., Springfield, Mass.

Discussion from the standpoints of:

- What Constitutes a Medical Staff? OSWALD H. ANDERSON, M.D., St. Louis.
- The Right of the Governing Board of the Hospital to Appoint the Medical Staff. JOSEPH C. DOANE, M.D., Philadelphia.
- Proper Procedure to Follow When Extending Hospital Privileges and Making Appointments to the Medical Staff. CHARLES H. YOUNG, M.D., Montclair, N. J.
- Selection and Appointment of Chief of Staff and Heads of Departments in Relation to Hospital Management. JESSIE J. TURNBULL, R.N., Pittsburgh.
- Accounting of Professional Services as a Means of Controlling Clinical Work. THOMAS R. PONTON, M.D., Chicago.

General Discussion. Opened by JOE R. CLEMMONS, M.D., New York.

Tuesday, 2:00—Rose Garden, Bellevue-Stratford Hotel

Panel Round Table Discussion: Problems Pertaining to Various Phases of Hospital Administration in the Large Hospital. Conducted by WILMAR M. ALLEN, M.D., Hartford, Conn.

- Administration: Maintaining good morale among hospital personnel, admitting and discharging procedure, responsibility for scientific work, conferences of administrator with heads of departments. FRANK B. GAIL, Camden, N. J.
- Accounting Control and Hospital Costs: Budget—predetermined costs, control of purchases, personnel, day by day control; issuance of food, medical supplies, etc.; total costs, functional costs, per capita costs (in and out-patients). GORDON T. BROAD, New York.
- Anesthesia: Essentials of a properly organized department, responsibility for selection of type of anesthetic to be used, pre-anesthetic examination of patient, elimination of anesthetic hazards. MILTON C. PETERSON, M.D., New York.
- Emergencies: Organization of emergency services, shock, hemorrhage, and poisoning, blood transfusion, emergency lighting in the hospital. JOHN M. T. FINNEY, JR., M.D., Baltimore.
- Control of Postoperative Infections from the Standpoint of Surgical Instruments: Unsterilized versus sterilized instruments, technique for cleansing and sterilizing surgical instruments, decreased inventory of surgical instruments, labor saving and other factors, in postoperative infections. CARL W. WALTER, M.D., Boston.
- Hospitalization and Compensation Charges: For hospitalization patients, for compensation or insurance patients, uniform charges, co-operative action among hospitals. NORA E. YOUNG, R.N., Brooklyn.

Tuesday, 2:00—South Garden, Bellevue-Stratford Hotel

Panel Round Table Discussion. General Theme: The Organization and Management of the Small Hospital. Conducted by CARL I. FLATH, Toronto.

The Importance of the Small Hospital in Certain Communities. CHARLES A. LINDQUIST, Elgin, Ill.

Discussion from the following viewpoints:

- Personnel: Securing adequate personnel, minimizing turnover, maintaining good morale, training hospital personnel. MILDRED WALKER, Wauseon, Ohio.
- Medical Staff Organization: Selecting and organizing the medical staff, controlling the clinical work, conducting medical staff conferences. HUSTON K. SPANGLER, M.D., Chicago.
- Medical Records: Securing medical records, filing and preserving medical records, using medical records. JAMES H. SPENCER, JR., M.D., Franklin, N. J.
- Clinical Laboratory Service: Providing adequate service, maintaining competent technical services, supervision and financing the clinical laboratory. LALL G. MONTGOMERY, M.D., Muncie, Ind.
- X-ray Service: Providing adequate service, maintaining competent technical services, supervising and financing the x-ray department. DAVID M. CALDWELL, M.D., Manchester, Conn.
- Nursing Service: Providing adequate service, supplementing nursing service with attendants or subsidiary workers, determining personnel requirements, maintaining permanency in personnel. EDNA D. PRICE, R.N., Concord, Mass.
- Financing: Assuring accounting efficiency, utilizing all sources of revenue, collecting delinquent accounts, stimulating philanthropic endeavor. O. K. FIKE, Richmond, Va.

Tuesday, 8:00 p.m.—St. Joseph's Hospital

Round Table Conference—Presentation and Discussion of Pertinent Hospital Problems Submitted by Hospital Executives. Conducted by MALCOLM T. MACEACHERN, M.D., Chicago.

Wednesday, 9:30—Rose Garden, Bellevue-Stratford Hotel

Joint Conference with American Association of Medical Record Librarians. ROBIN C. BUERKI, M.D., Chicago, presiding.

A Preview of the Present Status of Medical Records in the United States and Canada as seen by the American College of Surgeons. EARL W. WILLIAMSON, M.D. Chicago.

The Present Status of the Training of Medical Records Librarians. LILLIAN H. ERICKSON, R.R.L., Chicago.
Difficulties in Securing Good Medical Records in the Small Hospital and How to Overcome Them. GENEVIEVE HILGER, R.R.L., Decorah, Iowa.
The Place of the Medical Secretary in the Hospital. RUTH HESS, Bluefield, W. Va.
Overcoming Problems Incident to Securing Acceptable Specialty Medical Records. RAY K. DAILY, M.D., Houston, Texas.
Legal Aspects of Medical Records. HENRY H. CALDWELL, Chicago.
Round Table Conference—Medical Records Problems. Conducted by W. FRANKLIN WOOD, M.D., Waverley, Mass.

Wednesday, 2:00—Demonstrations in Local Hospitals

Children's Hospital. SUSAN C. FRANCIS, R.N., Superintendent.
Pediatric Nursing Care and Isolation Precautions: Infantile Eczema. DONALD M. PILLSBURY, M.D.
Children in Chapple Cabinet Cubicles. CHARLES C. CHAPPLE, M.D.
Administration of Blood Transfusions to Infants. AIMS C. MCGUINNESS, M.D.
Procedure and Technique in Making Up Infant Feedings—Milk Laboratory. AGNES H. ADDAMS and ARLENE SALEN.
Graduate Hospital of the University of Pennsylvania. DONALD C. SMELZER, M.D., Director.
Organization and Management of a Blood Bank. FRANK JONES, M.D., MELBA FISHBAUGH, and MARGUERITE LUKENS.
Preparation of Parenteral Solutions. ALEXANDER KELLER and MARGARET HIPPLE.
Technique of Preparation and Administration of Parenteral Solutions. FRANK JONES, M.D., and JOSEPHINE FAMBROUGH.
Hospital of the University of Pennsylvania. MARY V. STEPHENSON, Superintendent.
Central Dressing Room: Control of Supplies, Sterilization of Dressings and Supplies, Tray Set-ups, etc. GLADYS GEMMIL, R.N.
Pediatric Bedside Clinics: Demonstration of Pediatric Nursing Techniques. ELLA CRAGIN, R.N.
Use of the Out-patient Department in Teaching of the Student Nurse: Gastric Expression, Biliary Drainage, Use of the Miller-Abbott Tube. KENDALL A. ELSOM, M.D., and FRANCES NAGLE, R.N.
Resuscitation and Oxygen Therapy from the Physician's and Nurse's Viewpoint. IVAN B. TAYLOR, M.D., and ELIZABETH H. SCOTT, R.N.
The Nurses' Responsibility in Wangensteen Suction Drainage. EVELYN FARRAND, R.N.
Indirect Blood Transfusions; Use of Blood Banks. EVELYN FARRAND, R.N.
Venoclysis Procedure: Set-up, Solution, Nursing. EVELYN FARRAND, R.N.
Demonstration of Vasocillator Bed. MARY C. WENRICH, R.N.
Lankenau Hospital. ROBERT SHOEMAKER, 3rd., M.D., Executive Medical Officer.
Organization and Management of Medical Records Department. GILSON C. ENGEL, M.D., and staff.
Follow-up and Study of End-Results. STANLEY P. REIMANN, M.D., and staff.
United States Naval Hospital. Captain HENRY L. DOLLARD, M.C., Commanding Officer.
Physical Therapy. Lieut. CARL K. YOUNGKIN.
Jefferson Medical College Hospital. ROBERT B. NYE, M.D., Medical Director.
Organization, Management, and Clinic Methods—Curtis Clinic. ROBERT B. NYE, M.D., and HAYWARD R. HAMRICK, M.D.

Thursday, 9:30—Rose Garden, Bellevue-Stratford Hotel

DONALD C. SMELZER, M.D., Philadelphia, presiding.
Interference with Radio Reception Caused by Electro-Medical Equipment. H. B. WILLIAMS, M.D., New York.
Organization and Operating Problems of a Tumor Unit in a General Hospital. JOSEPH TENOPYR, M.D., Brooklyn.
Principles of Relationship Between Radiologists and Hospitals. B. R. KIRKLIN, M.D., Rochester, Minn.
Principles of Relationship Between Pathologists and Hospitals. FRANK HARTMAN, M.D., Detroit.
Principles of Relationship Between Anesthetists and Hospitals. EMERY A. ROVENSTINE, M.D., New York.
General Discussion. Opened by BASIL C. MACLEAN, M.D., Rochester, N. Y.

Thursday, 2:00—Demonstrations in Local Hospitals

Pennsylvania Hospital (Woman's Building). NORRIS W. VAUX, M.D., Obstetrician and Gynecologist-in-Chief.
Maternal Care, Obstetrical Technique, and Procedure:
Admission of Patient and Assignment to Accommodation. SPOTSWOOD ROBINS, M.D.
Prenatal Care. J. VERNON ELLSON, M.D.
Special Clinics. CRAIG WRIGHT MUCKLE, M.D.
Preparation of Patient. ROBERT M. SHIREY, M.D.
Observation of Patient in Labor. ROSS B. WILSON, M.D.
Delivery Room Set-up, Obstetrical Technique and Procedures. CLIFFORD B. LULL, M.D.
Care of the Patient Immediately Postpartum. JOHN C. ULLERY, M.D.
Care of the Patient Throughout Puerperium While in the Hospital. ROBERT A. KIMBROUGH, M.D.
Follow-up and End-Results. F. SIDNEY DUNNE, M.D.
Out-Patient Clinic. PENDLETON TOMPKINS, M.D.
Care of the Newborn. RALPH M. TYSON, M.D.
Pennsylvania Hospital. JOHN N. HATFIELD, Administrator. Food Service. MARGARET J. BENNETT.
Philadelphia General Hospital. WILLIAM G. TURNBULL, M.D., Superintendent.
Organization and Management of a Blood Bank. I. S. HNELESKI, M.D.
Nursing Technique. LORETTA M. JOHNSON, R.N.
Wills Hospital. STEPHEN WIERZBICKI, Superintendent.
Development of Consultation Clinics in Specialty Hospitals. JOSEPH V. KLAUDER, M.D., and WILLIAM FRANCIS WHELAN, M.D.
Nursing and Operating Room Technique in an Eye Hospital. GLADYS E. COLE and HILDA R. MILLER.

PRELIMINARY CLINICAL PROGRAM

ARRANGED IN THE FOLLOWING SUBDIVISIONS: GENERAL SURGERY, OBSTETRICS AND GYNECOLOGY, SURGERY OF BONES AND JOINTS, GENITO-URINARY SURGERY, FRACTURES AND OTHER TRAUMAS, NEUROSURGERY, THORACIC SURGERY, PLASTIC AND FACIOMAXILLARY SURGERY, BRONCHO-ESOPHAGOLOGY, OTORHINOLARYNGOLOGY, OPHTHALMOLOGY.

GENERAL SURGERY

Monday

HOSPITAL FOR DISEASES OF STOMACH

FRANCIS A. MANTZ—1. Operative and dry clinic.

JEFFERSON HOSPITAL

ROBERT LAYTON and SHERMAN EGER—11. Varicose veins.
J. HALL ALLEN and BENJAMIN HASKELL—1:30. Lesions of the anus and rectum.
HENRY K. MOHLER—2. Therapeutics in surgery.

MOUNT SINAI HOSPITAL

MOSES BEHREND and staff—1:15. Operations.

PENNSYLVANIA HOSPITAL

ORVILLE C. KING—2. Spinal anesthesia.
GARFIELD C. DUNCAN—3. Management of diabetes during acute infections and surgical complications.
SAMUEL BRADBURY—4. Surgical follow-up and group practice.

PHILADELPHIA GENERAL HOSPITAL

HUBLEY R. OWEN, JOHN PAUL NORTH, and LEWIS C. MANGES—1:30. Operative and dry clinic.
JOSEPH MCFARLAND and staff—2. Radiological clinic: Diagnosis of new cases; review of old cases and group discussion.
RUBIN M. LEWIS and staff—3:30. Treatment of varicose veins and their complications.
I. S. HNELESKI and ELEANOR VALENTINE—3. Management of blood bank at the Philadelphia General Hospital; demonstration of apparatus, technique of venesection and transfusion, and laboratory studies on refrigerated blood.

ST. JOSEPH'S HOSPITAL

EDWARD A. MALLON. Daily—historical exhibit commemorating the ninetieth anniversary of St. Joseph's Hospital.

STETSON HOSPITAL

ROBERT S. ALSTON, and C. E. SCHWARTZ—2. Operations.
CARL F. KOENIG—2. X-ray clinic.

TEMPLE UNIVERSITY HOSPITAL

WILLIAM A. STEEL and C. HOWARD MCDEVITT—2. Dry clinic: General and emergency surgery.
HARRY Z. HIBSHMAN, HARRY E. BACON, and staff—3. Proctology: Operative and dry clinic.
CARROLL S. WRIGHT—3. Dermatology and syphilology.

WEST JERSEY HOMEOPATHIC HOSPITAL

H. WESLEY JACK and staff—9. Operations: Cholecystectomy.

Tuesday

ABINGTON MEMORIAL HOSPITAL

JOHN EIMAN—2. Chemical problems in surgery.

AMERICAN ONCOLOGIC HOSPITAL

GEORGE M. DORRANCE, JOHN W. BRANSFIELD, and FREDERICK A. BOTHE—10. Operative and dry clinic: Cancer of rectum.
JOSEPH MCFARLAND—11. Pathological demonstration: Cancer of rectum.

BRYN MAWR HOSPITAL

JOHN B. FLICK and FREDERICK R. ROBBINS—9. Operations.
MAX STRUMIA—2. Surgical pathology. (Blood pictures in surgical infections with special emphasis on neutrophiles.)

CHESTNUT HILL HOSPITAL

JOHN F. MCCLOSKEY, JAMES A. LEHMAN, J. M. ELLZEY, JR., and JOHN J. SHOBER—10. Operations.

CHILDREN'S HOSPITAL

ORVILLE KING—11. Splenomegaly in children.

FITZGERALD-MERCY HOSPITAL

JAMES A. KELLY—9. Operations.
THOMAS J. RYAN—9. Operations.

FRANKFORD HOSPITAL

RALPH W. LORRY. Operative and dry clinic.

GERMANTOWN HOSPITAL

EDWARD B. HODGE, WILLIAM B. SWARTLEY, ROBERT S. ALSTON, STEPHEN D. WEEDER, and HANS MAY—10. Operations.

GRADUATE HOSPITAL OF UNIVERSITY OF PENNSYLVANIA

WILLIAM BATES—9. Dry clinic: Parietal neuralgia.
JOHN C. HOWELL and I. I. GOPADZE—11. Operations. Dry clinic: Treatment of so called subacromial bursitis.

HAHNEMANN HOSPITAL

A. B. WEBSTER—9. Operations.

HOSPITAL FOR DISEASES OF STOMACH

HERBERT R. HAWTHORNE, WILBUR W. OAKS, and PAUL H. NEESE—9. Operative and dry clinic.

HOSPITAL OF UNIVERSITY OF PENNSYLVANIA

I. S. RAVDIN and staff—9. Biliary tract operations.
J. E. RHOADS. The management of the hemorrhagic tendency of obstructive jaundice.
I. S. RAVDIN. The relation of diet to liver injury.
W. D. FRAZIER. The control of the external loss of bile.
H. P. ROYSTER. Visualization of the common bile duct.
O. V. BATSON. Incisions for biliary tract operations.
IVAN TAYLOR. Anesthesia in biliary tract operations.
I. S. RAVDIN. End-results in biliary tract surgery.

L. K. Ferguson, Louis Kaplan and William H. Erb—2. Painful shoulder: The differential diagnosis and treatment of painful lesions of the shoulder; acute subdeltoid bursitis; chronic bursitis; supraspinatus tendon rupture; brachial plexus neuritis with scalenus myositis.

JEANES HOSPITAL

Roscoe M. Teahan, Hoke Wammock, and Clarence A. Whitcomb—9. Operations: Panhysterectomy for carcinoma of uterine fundus; application of radium for carcinoma of cervix; vulvectomy for carcinoma; radical neck dissection for metastic carcinoma.

Staff—11. Dry clinic:

W. S. Hastings. A review of proposed methods of serological diagnosis of cancer.

A. M. Duff, Jr. The rapid diagnosis of fresh tissue.

Hoke Wammock. The control of pain of advanced cancer with irradiation.

C. A. Whitcomb. Presentation of treated oral lesions.

JEFFERSON HOSPITAL

Thomas A. Shallow and staff—10. Operations; ward walks.

Charles F. Nassau—11. Operations; ward walks.

George P. Muller—2. Operative and dry clinic.

J. Hall Allen and Benjamin Haskell—3. Proctological surgery.

LANKENAU HOSPITAL

Damon B. Pfeiffer, J. Montgomery Deaver and Albert Martin—9. Operations. Presentations: Acute appendicitis in children; aneurysm of the abdominal aorta simulating surgical kidney.

MEMORIAL HOSPITAL

James Lehman—9. Thyroid operations.

METHODIST EPISCOPAL HOSPITAL

Calvin M. Smyth, Jr. and staff—9:30. Operations.

MISERICORDIA HOSPITAL

B. R. Beltran and E. J. Garvin—9. Operations.

George P. Muller, F. Mogavero and F. T. McGinnis—9. Operations.

MOUNT SINAI HOSPITAL

Benjamin Lipshutz and staff—9. Operations.

NORTHEASTERN HOSPITAL

Joseph J. Toland—9. Operations.

PENNSYLVANIA HOSPITAL

Walter E. Lee and staff—9. Operative and dry clinic.

PHILADELPHIA GENERAL HOSPITAL

L. K. Ferguson and William H. Erb—9. Operative and dry clinic.

David P. Anderson, Jr.—9. End-results of herniorrhaphy; Ferguson operation plus steel wire sutures.

Staff—2. Symposium on biliary tract and gastric diseases:

L. K. Ferguson. Biliary tract surgery.

Truman G. Schnabel. Biliary tract disease from a medical standpoint.

E. Burville-Holmes. Roentgenological diagnosis of biliary tract disease.

Russell S. Boles, Helena Riggs and John Griffiths. Circulatory factors in the etiology of peptic ulcer.

W. Wayne Babcock. Gastric surgery.

Herman Ostrum. Roentgenological aspects of gastric disease.

William Brody. Use of gastroscope in gastric disease.

I. S. Hneleski and Eleanor Valentine—3. Management of blood bank at the Philadelphia General Hospital; demonstration of apparatus, technique of venesection and transfusion, and laboratory studies on refrigerated blood.

PRESBYTERIAN HOSPITAL

Edward B. Hodge, Ernest G. Williamson, and Lynn M. Rankin—9. Operations. Dry clinic: Postural drainage of peritonitis.

PROTESTANT EPISCOPAL HOSPITAL

I. M. Boykin and staff—9. Operations.

ST. CHRISTOPHER'S HOSPITAL

Harry E. Knox, John Wolf and Dr. Martin—10. Pediatric surgery.

ST. JOSEPH'S HOSPITAL

V. G. Burden—10. Dry clinic: Duodenal ulcer; pylorospasm; infantile pyloric stenosis.

ST. LUKE'S AND CHILDREN'S HOSPITAL

Desiderio Roman, R. W. Larer, H. K. Roessler, A. W. Hammer and staff—9. Operative clinic: Thyroid; gall bladder; carcinoma of the breast; herniorrphaphies.

John O. Bower and staff—9. Dry clinic: Operations on the stomach, showing advantages in use of very fine size catgut.

J. W. Post—9. Roentgenological examinations.

O. F. Barthmaier—9. Demonstration: Pathological and bacteriological examinations.

ST. MARY'S HOSPITAL

W. J. Ryan and J. J. Cancelmo—9. Operations.

V. R. Manning—1. Proctological clinic.

ST. VINCENT'S HOSPITAL

J. J. Cancelmo—9. Operative and dry clinic: Cryptorchidism, its reduction by operative measures.

TEMPLE UNIVERSITY HOSPITAL

W. Wayne Babcock, G. Mason Astley, W. Emory Burnett, and J. Norman Coombs—9. Operations.

W. Edward Chamberlain and staff—9. Radiological clinic.

William A. Steel and C. Howard McDevitt—2. General and emergency surgery.

U. S. NAVAL HOSPITAL

F. L. Conklin, W. T. Lineberry, and H. L. Pugh—9. Operations.

J. J. White—9. Demonstration: Kettering-Simpson hypertherm.

J. J. White—1. Demonstration: Kettering-Simpson hypertherm.

WEST JERSEY HOMEOPATHIC HOSPITAL

H. Wesley Jack and staff—10. Operations: Cholecystectomy and appendectomy.

WOMAN'S MEDICAL COLLEGE HOSPITAL

J. Stewart Rodman and associates—10:30. Operations.

WOMEN'S HOMEOPATHIC HOSPITAL

Lawrence Goldbacher—3. Rectal surgery.

Wednesday

ABINGTON MEMORIAL HOSPITAL

DAMON B. PFEIFFER, J. WALTER LEVERING, and J. M. DEAVER—2. Operations.

BROAD STREET HOSPITAL

A. B. WEBSTER and T. C. GEARY—10. Operations.

BRYN MAWR HOSPITAL

ARTHUR E. BILLINGS and CHARLES H. HARNEY—9. Operations.

CHESTNUT HILL HOSPITAL

WILLIAM B. SWARTLEY, S. DANA WEEDER, EDWARD F. MCLAUGHLIN, and WILLIAM SWARTLEY RINKER—10:30. Operations.

COOPER HOSPITAL

PAUL M. MECRAY, I. E. DEIBERT, F. W. SHAFER, and R. S. GAMON—9. Operative and dry clinic: Abdominal and thoracic surgery; empyema.

DELAWARE COUNTY HOSPITAL

DRURY HINTON and C. A. STEINER—9. Operative and dry clinic.

FITZGERALD-MERCY HOSPITAL

BASIL R. BELTRAN—9. Operations.
ALEXANDER E. BURKE—9. Operations.

FRANKFORD HOSPITAL

BENJAMIN H. CHANDLEE—9. Operations.

GERMANTOWN HOSPITAL

CHARLES F. MITCHELL, WALTER E. LEE, HARRY E. KNOX, and THOMAS M. DOWNS—10. Operations.

GRADUATE HOSPITAL OF UNIVERSITY OF PENNSYLVANIA

GEORGE M. PIERSOL, GEORGE C. GRIFFITH, and WALTER E. LEE—9. Dry clinic: Calcified constrictive pericarditis, medical and surgical aspects.
JOSEPH T. BEARDWOOD, JR., JOSEPH C. YASKIN, and WALTER E. LEE—10. Symposium on cancer: Pancreatic adenoma with hyperinsulinism, metabolic, neurological, and surgical aspects.
WALTER E. LEE, HARRY FARRELL, JONATHAN RHOADS, and NORMAN E. FREEMAN—11. Operative and dry clinic: Constrictive pericarditis.
COLLIER F. MARTIN—2. Lymphogranuloma venereum.

HAHNEMANN HOSPITAL

G. A. VAN LENNEP—9. Operations.

HOSPITAL FOR DISEASES OF STOMACH

SHERMAN A. EGER—9. Operative and dry clinic.
HERBERT R. HAWTHORNE, WILBUR W. OAKS, and PAUL H. NEESE—12. Operative and dry clinic.

HOSPITAL OF UNIVERSITY OF PENNSYLVANIA

E. L. ELIASON and staff—9. Operations: Biliary surgery.
JULIAN JOHNSON. Management of acute cholecystitis.
ROBERT B. BROWN. Hazards of cholecystectomy.
WILLIAM H. ERB. Pancreatitis and gall-bladder disease.
E. L. ELIASON. Surgical jaundice.
LLOYD W. STEVENS. Biliary fistula.
I. S. RAVDIN and staff—2. Dry clinic on pre- and postoperative care.
NORMAN E. FREEMAN. The management of surgical shock.
FRANCIS WOOD. The heart in surgical patients.
H. C. BAZETT. The effect of climatic conditions on blood volume.
J. H. GIBBON, JR. The problem of embolus in surgical patients.
J. E. RHOADS. The use of sulfanilamide in spreading peritonitis.
S. GOLDSCHMIDT. The danger of anoxemia during surgical operations.
J. S. LOCKWOOD. The mode of action of sulfanilamide and related compounds.
NORMAN E. FREEMAN. Some observations on peripheral vascular disease.
I. S. RAVDIN. The effect of recent advances of pre- and postoperative treatment on the morbidity and mortality of surgical operations.
L. K. FERGUSON, PAUL LOEFFLAD, WILLIAM H. ERB, LOUIS KAPLAN, and NORMAN E. FREEMAN—2. Treatment of varicose veins and ulcers; injection treatment of varicose veins; indications for and technique of ligation in the treatment of varicose veins; treatment of varicose ulcers; treatment of painful arteriosclerotic ulcers.

JEFFERSON HOSPITAL

GEORGE P. MULLER and staff—9. Dry clinic:
ADOLPH A. WALKLING. Cholangiography.
GEORGE P. MULLER. Subtotal gastrectomy.
JAMES SURVER. Carcinoma of breast; tumor clinic follow-up study over a 10 year period.
GEORGE P. MULLER and staff—11. Operations.
ROBERT LAYTON and SHERMAN EGER—11. Varicose vein clinic.
J. HALL ALLEN and BENJAMIN HASKELL—1:30. Lesions of the anus and rectum.
THOMAS A. SHALLOW—2. Operations: Colon and rectum.
WILLIAM S. NEWCOMET—4. Dry clinic: Cases of angiomata showing results of various methods of treatment.

JEWISH HOSPITAL

RALPH GOLDSMITH—9. Operations.
MOSES BEHREND—2. Operations.

LANKENAU HOSPITAL

GEORGE P. MULLER, GILSON C. ENGEL, JOSEPH O. KEEZEL, and HANS MAY—9. Operations.
STANLEY P. REIMAN and staff—11. Studies from clinical and research laboratory upon cancer, growth, etc.
GILSON C. ENGEL, and HANS MAY—11. Fractures of the neck of the femur; treatment and pathology with general discussion.

MEMORIAL HOSPITAL

BRUCE L. FLEMING—9. Operations.

METHODIST EPISCOPAL HOSPITAL

GEORGE J. SCHWARTZ and staff—10. Operations.

MISERICORDIA HOSPITAL

JAMES A. KELLY and D. C. GEIST—9. Operations.

NORTHERN LIBERTIES HOSPITAL

BYRON GOLDSMITH, and MORRIS SEGAL—9. Operative clinic.

PENNSYLVANIA HOSPITAL

PAUL A. BISHOP—2. Dry Clinic: Acute intestinal obstruction, with x-ray diagnosis and special reference to the Abbott tube.

WILLIAM A. WOLFF, and RUSSELL ELKINTON—4. Dry Clinic: Chemical control of surgical patients.

PHILADELPHIA GENERAL HOSPITAL

W. WAYNE BABCOCK—9. Dry clinic.

WILLIAM T. LEMMON—9. Operative clinic: Gall-bladder disease.

JOHN O. BOWER, JOHN C. BURNS, and HARRY B. TRACHTENBERG—9. Demonstration of use of very fine size catgut in gastro-intestinal surgery; management of spreading peritonitis due to perforated appendix, with special reference to the use of convalescent lyophilize serum.

HENRY S. RUTH—11. Choice of anesthetics in surgery.

I. S. HNELESKI and ELEANOR VALENTINE—3. Management of blood bank at the Philadelphia General Hospital; demonstration of apparatus, technique of venesection, and transfusion and laboratory studies on refrigerated blood.

PRESBYTERIAN HOSPITAL

WILLIAM BATES, JAMES B. MASON, and JOHN C. HOWELL—9. Dry clinic: Pseudo-abdominal lesions.

PROTESTANT EPISCOPAL HOSPITAL

Staff—9. Dry clinic:
M. L. ALLEN. X-ray therapy of inflammation.
I. M. BOYKIN. Problems in gall-bladder surgery.
R. L. LAYTON. Amputation in diabetic gangrene.
R. H. MEADE, Jr. Acute hemorrhagic pancreatitis.

ST. JOSEPH'S HOSPITAL

S. D. SPOTTS—9. Operations.

CHARLES F. NASSAU—10. Operations.

L. A. SOLOFF—3. Laboratory demonstration of surgical pathology.

ST. LUKE'S AND CHILDREN'S HOSPITAL

DESIDERIO ROMAN, R. W. LARER, H. K. ROESSLER, A. W. HAMMER, and staff—9. Operative clinic.

J. W. POST—9. Roentgenological examinations.

O. F. BARTHMAIER—9. Demonstration: Pathological and bacteriological examinations.

ST. MARY'S HOSPITAL

A. P. KEEGAN—9. Operations.

STETSON HOSPITAL

WILLIAM T. ELLIS and J. K. MARKS—12. Operations.

CARL E. KOENIG—2. X-ray clinic.

ROBERT S. ALSTON and C. E. SCHWARTZ—2. Operations.

TEMPLE UNIVERSITY HOSPITAL

W. WAYNE BABCOCK, G. MASON ASTLEY, W. EMORY BURNETT, and J. NORMAN COOMBS—9. Operations.

W. EDWARD CHAMBERLAIN and staff—9. Radiological clinic.

WILLIAM A. STEEL and C. HOWARD MCDEVITT—2. General and emergency surgery.

HARRY Z. HIBSHMAN, HARRY E. BACON and staff—3. Operative and dry clinic.

U. S. NAVAL HOSPITAL

F. L. CONKLIN, W. T. LINEBERRY, and H. L. PUGH—9. Operations.

J. J. WHITE—9. Demonstration: Kettering-Simpson hypertherm.

J. J. WHITE—1. Demonstration: Kettering-Simpson hypertherm.

C. K. YOUNGKIN—2. Demonstration: Physical therapy.

C. F. MORRISON—2. Demonstration: Spinograms.

WOMEN'S HOMEOPATHIC HOSPITAL

R. W. LARER—9. Operations.

C. L. SHOLLENBERGER—1. Operations.

Thursday

ABINGTON MEMORIAL HOSPITAL

DAMON B. PFEIFFER, J. WALTER LEVERING, I. M. BOYKIN, J. M. DEAVER, and staff—2. Dry clinic: Peptic ulcer and its surgical complications.

BRYN MAWR HOSPITAL

RALPH S. BROMER—9. X-ray conference: Diseases of bone.

J. STEWART RODMAN and ALAN P. PARKER—9:30. Operations.

CHESTNUT HILL HOSPITAL

WILLIAM C. SHEEHAN, L. H. HERGESHEIMER, HANS MAY, and H. P. MACNEAL—10. Operations.

FAY K. ALEXANDER—11. Intra-abdominal hernia, x-ray studies.

CHILDREN'S HOSPITAL

WALTER E. LEE and FREDERICK ROBBINS—11. Operations and ward rounds: Surgery in children.

COOPER HOSPITAL

PAUL M. MECRAY, I. E. DEIBERT, F. W. SHAFER, and R. S. GAMON—9. Operative and dry clinics: General surgery, fractures, carcinoma of breast.

FITZGERALD-MERCY HOSPITAL

JAMES A. KELLY—9. Operations.

THOMAS J. RYAN—9. Operations.

FRANKFORD HOSPITAL

CHARLES F. NASSAU—9. Operations.

GERMANTOWN HOSPITAL

EDWARD B. HODGE, WILLIAM B. SWARTLEY, ROBERT S. ALSTON, STEPHEN D. WEEDER, and HANS MAY—10. Operations.

GRADUATE HOSPITAL OF UNIVERSITY OF PENNSYLVANIA

HERBERT R. HAWTHORNE—9. Operations.

HAHNEMANN HOSPITAL

WILLIAM L. SYLVIS—9. Operations.

HOSPITAL OF UNIVERSITY OF PENNSYLVANIA

I. S. RAVDIN and staff—9. Gastro-intestinal operations.
I. S. RAVDIN. The effect of nutritional edema on failure of stomach to empty.
ALFRED STENGEL, JR. Nutrition in gastro-intestinal cases.
W. D. THOMPSON, JR. Factors conditioning wound healing in surgical patients.
W. O. ABBOTT. The use of the Miller-Abbott tube in acute intestinal obstruction.
W. D. FRAZIER. Indications for operation in patients with gastric or duodenal ulcer.

JEFFERSON HOSPITAL

KENNETH E. FRY—9. Peritoneoscopy as a diagnostic aid in surgery.
THOMAS A. SHALLOW and staff—10. Operations.
HOBART A. REIMANN—2. Medico-surgical problems.
J. HALL ALLEN and BENJAMIN HASKELL—3. Proctological operations.

JEANES HOSPITAL

ROSCOE M. TEAHAN, HOKE WAMMOCK, and CLARENCE A. WHITCOMB—9. Operations: Abdominoperineal resection of rectum; excision of carcinoma of bladder; implantation of radon for carcinoma of mouth.
Staff—11. Dry clinic.
W. S. HASTINGS. A review of proposed methods of serological diagnosis of cancer.
A. M. DUFF, JR. The rapid diagnosis of fresh tissue.
HOKE WAMMOCK. The control of pain of advanced cancer with irradiation.
C. A. WHITCOMB. Presentation of treated oral lesions.

JEWISH HOSPITAL

FRANK B. BLOCK—9. Operations.

LANKENAU HOSPITAL

DAMON B. PFEIFFER, J. MONTGOMERY DEAVER, and ALBERT MARTIN—9. Operations. Discussion of cancer of rectum with report of cases.

METHODIST EPISCOPAL HOSPITAL

CALVIN M. SMYTH, JR. and staff—9. Operations.

MISERICORDIA HOSPITAL

B. R. BELTRAN and E. GARVIN—9. Operations.
GEORGE P. MULLER, F. MOGAVERO, and F. T. MCGINNIS—9. Operations.

MOUNT SINAI HOSPITAL

BENJAMIN LIPSHUTZ and staff—9. Operations.

PENNSYLVANIA HOSPITAL

WALTER E. LEE and staff—9. Operative and dry clinic.

PHILADELPHIA GENERAL HOSPITAL

S. DALE SPOTTS and HUGH ROBERTSON—9. Operative and dry clinic.
L. K. FERGUSON and WILLIAM H. ERB—9. Operative clinic.
Staff—9. Symposium on metabolic diseases:
EDWARD S. DILLON. Surgical complications of diabetes mellitus.
WILLIAM H. ERB. Diabetic surgery.
ROBERT G. TORREY. Medical aspects of diseases of thyroid gland.
PATRICK A. MCCARTHY. Surgery of thyroid gland.
Staff—2. Symposium on cancer:
LOUIS H. CLERF. Carcinoma of larynx.
JOSEPH KLAUDER. Malignant melanomas.
LAWRENCE CURTIS. Plastic procedures of treated carcinoma.
B. P. WIDMANN. Irradiation of superficial intra-oral carcinoma.
JOHN HOWELL. Treatment of carcinoma of rectum.
CHARLES BEHNEY. Carcinoma of ovary.
JOSEPH MCFARLAND. To be announced.
TRUMAN SCHNABEL. Bronchogenic carcinoma.
Staff—2. Symposium on general surgery:
FENWICK BEEKMAN and EDWARD CROSSAN. Present status of the surgical treatment of acute osteomyelitis.
D. B. PFEIFFER. Indications for gastro-enterostomy in the treatment of peptic ulcer.
S. DANA WEEDER and WILLIAM LEMMON. Subtotal gastrectomy for peptic ulcer.
I. S. HNELESKI and ELEANOR VALENTINE—3. Management of blood bank at the Philadelphia General Hospital; demonstration of apparatus, technique of venesection and transfusion, and laboratory studies on refrigerated blood.

PRESBYTERIAN HOSPITAL

ELDRIDGE L. ELIASON, FREDERICK BOTHE, and JOHN PAUL NORTH—9. Operative and dry clinic.
ELDRIDGE L. ELIASON. Pyloric obstruction.
FREDERICK BOTHE. Mesenteric adenitis.
JOHN PAUL NORTH. Unusual causes of intestinal obstruction.
F. G. HANGEN and RUTH HARREL. Inhalation anesthesia in abdominal surgery.
L. K. DEAN. Postoperative complications of gastro-intestinal operations.

PROTESTANT EPISCOPAL HOSPITAL

E. T. CROSSAN and staff—9. Operations.

ST. CHRISTOPHER'S HOSPITAL

HARRY E. KNOX, JOHN WOLF, and DR. MARTIN—10. Pediatric surgery.

ST. JOSEPH'S HOSPITAL

C. S. HERRMAN—9. Operations.
V. R. MANNING—2. Proctological clinic.

ST. LUKE'S AND CHILDREN'S HOSPITAL

DESIDERIO ROMAN, R. W. LARER, H. K. ROESSLER, A. W. HAMMER, and staff—9. Operative clinic.
JOHN O. BOWER and staff—9. Dry clinic: A demonstration of the use of 5-0 chromic catgut in pericardectomy and common bile duct, neurorrhaphy and tenorrhaphy.
J. W. POST—9. Demonstration: Roentgenological examinations.
O. F. BARTHMAIER—9. Demonstration: Pathological and bacteriological examinations.

ST. MARY'S HOSPITAL

J. J. TOLAND, JR.—9. Operations.

TEMPLE UNIVERSITY HOSPITAL

W. WAYNE BABCOCK, G. MASON ASTLEY, and J. NORMAN COOMBS—9. Operations.
E. EDWARD CHAMBERLAIN and staff—9. Radiological clinic.
WILLIAM A. STEEL and C. HOWARD MCDEVITT—2. Dry clinic: General and emergency surgery.

U. S. NAVAL HOSPITAL

F. L. CONKLIN, W. T. LINEBERRY, and H. L. PUGH—9. Operations.
J. J. WHITE—9. Demonstration: Kettering-Simpson hypertherm.
J. J. WHITE—1. Demonstration: Kettering-Simpson hypertherm.

WEST JERSEY HOMEOPATHIC HOSPITAL

H. WESLEY JACK and staff—10. Operations: Repair of hernias.
H. WESLEY JACK and staff—1. Operations: Carcinoma of breast; appendectomy.

WOMAN'S HOSPITAL OF PHILADELPHIA

CALVIN M. SMYTH, JR. and staff—9. Operations.

Friday

ABINGTON MEMORIAL HOSPITAL

DAMON B. PFEIFFER, J. WALTER LEVERING, and J. M. DEAVER—2. Operations.

AMERICAN ONCOLOGIC HOSPITAL

JOHN W. BRANSFIELD and GORDON CASTIGLIANO—9:30. Operative and dry clinic: Cancer of breast.

BRYN MAWR HOSPITAL

WALTER E. LEE and T. MCKEAN DOWNS—9. Operations.

COOPER HOSPITAL

PAUL M. MECRAY, I. E. DEIBERT, F. W. SHAFER, and R. S. GAMON—9. Operative clinic: General, abdominal, and thoracic surgery.

FITZGERALD-MERCY HOSPITAL

BASIL R. BELTRAN—9. Operations.
ALEXANDER E. BURKE—9. Operations.

GERMANTOWN HOSPITAL

CHARLES F. MITCHELL, WALTER E. LEE, HARRY E. KNOX, and THOMAS M. DOWNS—10. Operations.

GRADUATE HOSPITAL OF UNIVERSITY OF PENNSYLVANIA

WALTER E. LEE and HENRY LEROY BOCKUS—9. Clinical conference: Gastro-intestinal diseases, diagnosis, treatment and surgical problems. (Demonstrations of cases.)
WALTER E. LEE, HARRY FARRELL, JONATHAN RHOADS, and NORMAN E. FREEMAN—11. Operative clinic.

HAHNEMANN HOSPITAL

HENRY S. RUTH—2. Demonstration of sacral caudal block.
JAMES D. SCHOFIELD and staff—2. Operations.

HOSPITAL FOR DISEASES OF STOMACH

HERBERT R. HAWTHORNE, WILBUR W. OAKS, and PAUL H. NEESE—9. Operative and dry clinic.
FRANCIS A. MANTZ—1. Operative and dry clinic.

HOSPITAL OF UNIVERSITY OF PENNSYLVANIA

E. L. ELIASON and staff—9. Gastro-intestinal operations.
E. L. ELIASON—Management of bleeding ulcer cases.
ROBERT B. BROWN—Diagnostic difficulties in colonic lesions.
L. K. FERGUSON. Colonic operations: Surgical diathermy in treatment of rectal disease.
WILLIAM H. ERB. Postoperative care of peptic ulcer cases.
JULIAN JOHNSON. Treatment of acute ileitis.
L. K. FERGUSON and staff—2. Treatment of diseases of the anal canal and rectum.
L. H. HERGESHEIMER. Treatment of hemorrhoids by injection; hemorrhoidectomy in ambulatory patients with local anesthesia.
JOHN B. CLEMENT. Treatment of fissure-in-ano in ambulatory patients by using oil soluble anesthetics.
KENNETH KRESSLER. The treatment of pruritus ani.
JOEL NASS. Treatment of carcinoma of the rectum and of rectal polyps by electrosurgery.
PAUL H. SHIFFER. Nonoperative treatment of ulcerative colitis.
L. K. FERGUSON. One and two stage operations for fistula-in-ano.

JEFFERSON HOSPITAL

GEORGE P. MULLER and staff—9. Dry clinic. Ward walks and case demonstrations.
JAMES SURVER. Pathological demonstration: Small bowel tumors.
GEORGE WILLAUER. Treatment of varicose veins.
HOWARD H. BRADSHAW. Ward rounds.
ROBERT LAYTON and SHERMAN EGER—11. Varicose vein clinic.
GEORGE P. MULLER and staff—11. Operations.
THOMAS A. SHALLOW—11. Operations.
Staff—1. Regular meeting of tumor clinic, department of neoplastic diseases.
J. HALL ALLEN and BENJAMIN HASKELL—1:30. Lesions of the anus and rectum.

JEWISH HOSPITAL

NORMAN S. ROTHSCHILD—9. Operations.
HENRY TUMEN—9. Gastroscopic clinic.

LANKENAU HOSPITAL

GEORGE P. MULLER, GILSON C. ENGEL, JOSEPH O. KEEZEL, and HANS MAY—9. Operations. Dry clinic: Correlating surgical with medical division regarding pre- and post-operative care of goiter, diabetic, peptic ulcer, and jaundiced patients.
GILSON C. ENGEL and HANS MAY—11. Fractures of the neck of the femur; treatment and pathology, with general discussion.

MEMORIAL HOSPITAL

JAMES LEHMAN—9. Operations.

MISERICORDIA HOSPITAL

J. A. KELLY and D. C. GEIST—9. Operations.
T. J. RYAN—9. Operations and symposium on peripheral vascular disease.

MOUNT SINAI HOSPITAL

BENJAMIN LIPSHUTZ and LOUIS KAPLAN—9. Operations: Postoperative distention; perforation in appendicitis.
MOSES BEHREND and staff—1:15. Operations.

PENNSYLVANIA HOSPITAL

JOHN B. FLICK and staff—9. Operative and dry clinic.

PHILADELPHIA GENERAL HOSPITAL

PATRICK A. MCCARTHY—9. Operative and dry clinic.
B. P. WIDMANN—2. Radium and x-ray therapy.

PRESBYTERIAN HOSPITAL

HENRY P. BROWN and ORVILLE C. KING—9. Operative and dry clinic.

PROTESTANT EPISCOPAL HOSPITAL

I. M. BOYKIN and staff—9. Operations.

ST. JOSEPH'S HOSPITAL

JAMES A. KELLY—10. Operations.

ST. LUKE'S AND CHILDREN'S HOSPITAL

DESIDERIO ROMAN, R. W. LARER, H. K. ROESSLER, A. W. HAMMER, and staff—9. Operative clinic.
J. W. POST—9. Roentgenological examinations.
O. F. BARTHMAIER—9. Demonstration: Pathological and bacteriological examinations.

ST. MARY'S HOSPITAL

P. A. MCCARTHY—9. Operations.
J. A. KELLY and E. H. WEISS—9. Operations.

STETSON HOSPITAL

WILLIAM T. ELLIS and J. K. MARKS—12. Operations.
CARL F. KOENIG—2. X-ray clinic.
ROBERT S. ALSTON and C. E. SCHWARTZ—2. Operations.

TEMPLE UNIVERSITY HOSPITAL

W. WAYNE BABCOCK, G. MASON ASTLEY, W. EMORY BURNETT, and J. NORMAN COOMBS—9. Operations.
W. EDWARD CHAMBERLAIN and staff—9. Radiological clinic.
WILLIAM A. STEEL and C. HOWARD MCDEVITT—2. Dry clinic: General and emergency surgery.
CARROLL S. WRIGHT—2. Dermatology and syphilology.
HARRY Z. HIBSHMAN, HARRY E. BACON, and staff—3 Operative and dry clinic.

WEST JERSEY HOMEOPATHIC HOSPITAL

H. WESLEY JACK and staff—10. Operations: Carcinoma of breast.
H. WESLEY JACK and staff—1. Operations: Appendectomies.

WOMAN'S MEDICAL COLLEGE HOSPITAL

HUBLEY R. OWEN—10. Operative clinic: Hernia.
JAMES LEHMAN—10. Operative clinic: Thyroid.
J. STEWART RODMAN—10:30. Operative clinic: Breast.

OBSTETRICS AND GYNECOLOGY

Monday

HOSPITAL OF UNIVERSITY OF PENNSYLVANIA

Daily Scientific Exhibits

DOUGLAS P. MURPHY. Tocographic studies of uterine motility during pregnancy and labor.
PAUL O. KLINGENSMITH. Exhibits showing influence of variations in pelvic configuration upon the mechanism of labor.
CARL BACHMAN. Exhibits showing the techniques for the quantitative determination of estrogens and pregnandiol in pregnancy urine.
FRANKLIN L. PAYNE. Hormone studies in hydatidiform mole and chorion epithelioma.
F. SIDNEY DUNNE. Functioning ovarian tumors.

MEMORIAL HOSPITAL

Z. B. NEWTON—2. Gynecological operations.

TEMPLE UNIVERSITY HOSPITAL

HARRY A. DUNCAN—12. Operative and dry clinic.
Obstetrical staff: Daily exhibition and demonstration on fluid balance and weight-control in pregnancy.

WOMAN'S HOSPITAL OF PHILADELPHIA

ELEANOR H. BALPH and staff—1. Urological and gynecological clinic.

Tuesday

BROAD STREET HOSPITAL

N. F. PAXSON and M. J. BENNETT—9. Operative and dry clinics: Ovarian grafting as a therapeutic method for endocrine disorders; presentation of cases of hypermenorrhea and hypomenorrhea, pre- and postoperative, technique of new method, discussion and illustration by motion pictures in color.
N. F. PAXSON and M. J. BENNETT—2. Operations: Ovarian grafting for hyper- and hypomenorrhea, 4 cases.

BRYN MAWR HOSPITAL

CHARLES A. BEHNEY—9. Gynecological operations.

COOPER HOSPITAL

T. B. LEE and GORDON F. WEST—9. Operations.

DELAWARE COUNTY HOSPITAL

CLIFFORD B. LULL and J. VERNON ELLSON—9. Operations.

FITZGERALD-MERCY HOSPITAL

JOSEPH V. MISSETT—11. Gynecological operations.

HAHNEMANN HOSPITAL

NEWLIN F. PAXSON and HENRY D. LAFFERTY—9. Clinical pathological conference and ward rounds: Chronic nephritis and pregnancy, placenta praevia, x-ray pelvimetry.

HOSPITAL FOR DISEASES OF STOMACH

MARIO A. CASTALLO—11. Operative and dry clinic.

HOSPITAL OF UNIVERSITY OF PENNSYLVANIA

CHARLES C. NORRIS, HOWARD C. TAYLOR, JR., and staff—9. Gynecological operations and demonstrations.
CHARLES C. NORRIS, CHARLES A. BEHNEY, and PENDLETON TOMPKINS—2. Round table discussion: The treatment of cervical carcinoma. George Gray Ward, New York, chairman.

JEANES HOSPITAL

ROSCOE M. TEAHAN, HOKE WAMMOCK, and CLARENCE A. WHITCOMB—9. Operations: Panhysterectomy for carcinoma of uterine fundus; application of radium for carcinoma of cervix; vulvectomy for carcinoma; radical neck dissection for metastatic carcinoma.

JEFFERSON HOSPITAL

P. BROOKE BLAND—9. Gynecological operations.
HARRY STUCKERT—10. Obstetrical ward rounds.
JOHN B. MONTGOMERY—12. Postoperative follow-up clinic.
J. B. BERNSTINE and GEORGE B. BLAND—12. Demonstration of vaccine prevention of puerperal sepsis.
MARIO CASTALLO—12:30. Organization and conduct of obstetrical clinic for treatment of syphilis and gonorrhea complicating pregnancy; results of ten years' experience.

KENSINGTON HOSPITAL FOR WOMEN

E. A. SCHUMANN, ADRIAN VOEGELIN, Z. B. NEWTON, F. J. KOWNACKI, C. T. BEECHAM, and GEORGE C. HANNA, JR.—9. Gynecological operations with special reference to anesthesia. Hysterectomy, avertin; plastic, morphine and scopolamin; laparotomy, ovarian cyst, local; cesarean section, local.

LANKENAU HOSPITAL

E. P. BARNARD—10. Dry clinic, followed by cesarean section.
J. CALVIN HARTMAN. Use of Keilland forceps.
ROSS B. WILSON. Obstetric analgesia.
JULIAN LYON. Care of the premature baby.

MISERICORDIA HOSPITAL

J. A. SHARKEY—3. Lecture: Postpartum pulmonary complications.

PENNSYLVANIA HOSPITAL

NORRIS W. VAUX and staff—9. Operations and demonstration of cases.

NORRIS W. VAUX and staff—2. Demonstration of Lying-In Hospital technique and procedure:

SPOTSWOOD ROBINS. Admission of patient and assignment to accommodation.

J. VERNON ELLSON. Prenatal care.

CRAIG WRIGHT MUCKLE. Special clinics.

ROBERT M. SHIREY. Preparation of patient for labor.

ROSS B. WILSON—Observation of patient in labor.

CLIFFORD B. LULL. Delivery-room setup, obstetrical technique and procedures.

JOHN C. ULLERY. Care of the patient immediately postpartum.

ROBERT A. KIMBROUGH. Care of the patient throughout puerperium while in the hospital.

F. SIDNEY DUNNE. Follow-up and end-results.

PENDLETON S. TOMPKINS. Out-patient clinic.

RALPH M. TYSON. Care of the newborn.

PHILADELPHIA GENERAL HOSPITAL

C. A. BEHNEY—11. Dry clinic: Tumors in gynecological practice.

PRESBYTERIAN HOSPITAL

GEORGE M. LAWS, JAMES P. LEWIS, and DONALD RIEGEL—2. Gynecological operations.

PRESTON RETREAT

JOHN C. HIRST, ROBERT SHIREY, and ROBERT SHOEMAKER—2. Demonstration of methods, results, and clinical significance of studies in Vitamin A in pregnancy, as indicated by visual purple estimation from the Feldman adaptometer; surgical demonstration of technique of puerperal sterilization from first to fifth postpartum day by means of Pomeroy tubal-ligation-sterilization through the Pfannenstiel incision under local anesthesia; motion picture in color of the new Pfannenstiel-B. C. Hirst-Kerr extraperitoneal cesarean section, followed by operation if case is available.

ST. LUKE'S AND CHILDREN'S HOSPITAL

WARREN C. MERCER and staff—9. Operative clinic: Supravaginal hysterectomies and vaginal repairs.

ST. VINCENT'S HOSPITAL

WILLIAM F. MORRISON—10. Female gonorrheal clinic: Administering cautery and exhibition of cauterized cases.

STETSON HOSPITAL

STEPHEN E. TRACY and staff—9. Gynecological clinic.

TEMPLE UNIVERSITY HOSPITAL

J. O. ARNOLD—3. Obstetrical clinic, round table discussion.

WOMAN'S HOSPITAL OF PHILADELPHIA

MARGARET C. STURGIS and staff—9. Operative and dry clinics: Gynecological sterility.

ALBERTA PELTZ and staff—9. Prenatal clinic.

WOMEN'S HOMEOPATHIC HOSPITAL

F. L. HUGHES—9. Gynecological clinic.

Wednesday

AMERICAN ONCOLOGIC HOSPITAL

STEPHEN E. TRACY, A. VAUGHAN WINCHELL, and EMMETT F. CICCONE—10. Operative and dry clinic: Cancer of cervix.

BRYN MAWR HOSPITAL

JAMES L. RICHARDS—9. Gynecological operations: Suspension of uterus and hysterectomy.

CHESTNUT HILL HOSPITAL

FRANKLIN L. PAYNE—9. Operations.

EDWARD A. SCHUMANN and CLAYTON T. BEECHAM—9:30. Operations.

FITZGERALD-MERCY HOSPITAL

W. BENSON HARER—9. Gynecological operations.

FRANKFORD HOSPITAL

GEORGE C. HANNA, JR. and WALLACE M. MARTIN—1:30. Operative and dry clinics: Obstetrical.

GERMANTOWN HOSPITAL

E. P. BARNARD and J. CALVIN HARTMAN—9. Operative and dry clinics:

J. CALVIN HARTMAN. Discussion on prenatal care.

Z. B. NEWTON. Operations.

WINSLOW TOMPKINS. Relationship between diet and the anemias of pregnancy.

CHRISTOPHER M. TURMAN. Interpartum separation of the pubic symphysis.

ROBERT L. PITTFIELD. Use of typhoid vaccine in phlebitis.

JOHN W. COULTER. Signs and symptoms of premature separation not always text book type.

GRADUATE HOSPITAL OF UNIVERSITY OF PENNSYLVANIA

W. R. NICHOLSON—9. Gynecological operations.

HAHNEMANN HOSPITAL

LEON CLEMMER and NEWLIN F. PAXSON—2. Obstetrical operations.

HOSPITAL FOR DISEASES OF STOMACH

FRANCIS H. EATON—2. Urethral lesions in women.

HOSPITAL OF UNIVERSITY OF PENNSYLVANIA

CARL E. BACHMAN and staff—9. Obstetrical operations and demonstrations.

DOUGLAS P. MURPHY and PAUL O. KLINGENSMITH—2. Round table discussion: The relative importance of disproportion and inertia uteri in failed trial labor. WILLIAM E. CALDWELL, New York, chairman.

JEFFERSON HOSPITAL

BROOKE M. ANSPACH, JOHN B. MONTGOMERY and staff—9. Operations.

THADDEUS L. MONTGOMERY, MARIO CASTALLO, and CLYDE SPANGLER—9. Operations.

ARTHUR FIRST—12. Endocrine factors in the vitality and development of the fetus.

ABRAHAM RAKOFF—12. New methods in the titration of prolan and estrin; results of such titration in normal and complicated pregnancies.

L. G. FEO—12. Studies in the parasitology and bacteriology of the vagina.

LEOPOLD GOLDSTEIN—12. Glycogen content and acidity of the vagina in pregnancies and its complications.

MEMORIAL HOSPITAL

A. W. VOEGELIN—2. Gynecological operations.

METHODIST EPISCOPAL HOSPITAL

L. C. HAMBLOCK and staff—9. Obstetrical operations and demonstration of Caldwell-Morton apparatus for pelviography.

MOUNT SINAI HOSPITAL

CHARLES MAZER and staff—9. Operations. Exhibition and motion pictures: Investigative problems of the barren marriage.

PENNSYLVANIA HOSPITAL

NORRIS W. VAUX and staff—9. Operations and demonstration of cases.

PHILADELPHIA COUNTY MEDICAL SOCIETY

Demonstration of Committee Activities—4:30. Each committee will take a half hour and discuss three typical deaths in their respective group. Round table discussion.

PHILIP F. WILLIAMS, chairman, Committee on Maternal Welfare.

THADDEUS L. MONTGOMERY, chairman, Committee on the Study of Fetal Deaths.

RALPH TYSON, chairman, Committee on the Study of Neo-Natal Deaths.

PRESBYTERIAN HOSPITAL

CHARLES BEHNEY and JOHN GRIFFITH—9. Gynecological clinic.

ST. JOSEPH'S HOSPITAL

F. H. MAIER—11. Gynecological operations.
HARRY STUCKERT—11. Obstetrical clinic.
J. F. CARROLL—2. Obstetrical clinic.

ST. MARY'S HOSPITAL

L. J. WOJCZYNSKI—9. Gynecological clinic.
P. J. CARRERAS—9. Obstetrical clinic.
J. M. LAFERTY—1. Obstetrical clinic.
W. H. SCHMIDT—1. Radiological clinic.

TEMPLE UNIVERSITY HOSPITAL

J. O. ARNOLD—3. Obstetrical clinic, round table discussion.

WOMAN'S HOSPITAL OF PHILADELPHIA

ALBERTA PELTZ and staff—9. Prenatal clinic.

Thursday

BROAD STREET HOSPITAL

N. F. PAXSON and M. J. BENNETT—9. Demonstration: New method of studying ovarian activity and the menstrual cycle by means of human vaginal smears. Lantern slide demonstration and visit to laboratory showing technique: Normal cycle; artificial castration; menopause; hypermenorrhea; hypomenorrhea.

N. F. PAXSON and M. J. BENNETT—2. Clinical conference: Ovarian graft as a therapeutic method for endocrine disorders; presenting cases of castration and menopause, postoperative follow-up; discussion of technique used, illustrated by motion pictures in color.

BRYN MAWR HOSPITAL

J. O. GRIFFITHS and J. Y. HOWSON—2. Obstetrical clinic

COOPER HOSPITAL

T. B. LEE and GORDON F. WEST—9. Operative clinic: Gynecological.

A. B. DAVIS and G. B. GERMAN—2. Operative and dry clinic: Maternal mortality in New Jersey.

FITZGERALD-MERCY HOSPITAL

JOSEPH V. MISSETT—11. Gynecological operations.

HAHNEMANN HOSPITAL

EARL B. CRAIG and FRANK J. FROSCH—9. Operative and dry clinic: Gynecological.

EARL B. CRAIG and FRANK J. FROSCH—2. Operative and dry clinic: Gynecological.

HOSPITAL FOR DISEASES OF STOMACH

TOBY A. GRECO—9. Interposition and Fothergill operations.

J. S. RAUDENBUSH—11. Operative and dry clinic.

HOSPITAL OF UNIVERSITY OF PENNSYLVANIA

CHARLES C. NORRIS, HOWARD C. TAYLOR, JR., and staff—9. Gynecological operations and demonstrations.

FRANKLIN L. PAYNE—2. Round table discussion: The diagnosis and treatment of hydatidiform mole and chorionepithelioma. BENJAMIN P. WATSON, New York, chairman.

JEFFERSON HOSPITAL

LEWIS C. SCHEFFEY, I. CHARLES LINTGEN, and staff—9. Operations.
CLYDE M. SPANGLER—10. Ward rounds.
M. M. GINSBERG—10:30. Cystoscopic clinic.
EDWARD BURT—11. Studies in fetal asphyxia.
THADDEUS L. MONTGOMERY—11. Intrapartum factors in fetal and maternal mortality.
JOHN H. DUGGER—11. A study of rupture of the uterus.
Staff—12. Round table discussion: The practical application of endocrine therapy in gynecological and obstetrical practice. Discussion to be participated in by a number of the leading gynecologists and obstetricians. EMIL NOVAK, Baltimore, chairman.
I. CHARLES LINTGEN—12. Postoperative follow-up clinic.
BROOKE M. ANSPACH and LEWIS C. SCHEFFEY—3. Clinical conference on gynecology.

MOUNT SINAI HOSPITAL

BERNARD MANN and staff—9. Operations.

NORTHEASTERN HOSPITAL

ALFRED H. DIEBEL—10. Gynecological operations.

PENNSYLVANIA HOSPITAL

NORRIS W. VAUX and staff—9. Operations and demonstration of cases.

NORRIS W. VAUX and staff—2. Demonstration of Lying-In Hospital technique and procedure.

SPOTSWOOD ROBINS. Admission of patient and assignment to accommodation.

J. VERNON ELLSON. Prenatal care.

CRAIG WRIGHT MUCKLE. Special clinics.

ROBERT M. SHIREY. Preparation of patient for labor.

ROSS B. WILSON. Observation of patient in labor.

CLIFFORD B. LULL. Delivery-room setup, obstetrical technique and procedure.

JOHN C. ULLERY. Care of the patient immediately postpartum.

ROBERT A. KIMBROUGH. Care of the patient throughout puerperium while in the hospital.

F. SIDNEY DUNNE. Follow-up and end-results.

PENDLETON TOMPKINS. Out-patient clinic.

RALPH M. TYSON. Care of the newborn.

PHILADELPHIA GENERAL HOSPITAL

EDWARD A. SCHUMANN, JOSEPH MISSETT, JR., WILLIAM ELY, and C. BEECHAM—9. Gynecological operations.

PRESBYTERIAN HOSPITAL

GEORGE M. LAWS and staff—2. Gynecological operations.
PHILIP F. WILLIAMS—2. Demonstration of prenatal clinic.

ST. JOSEPH'S HOSPITAL

WILLIAM J. THUDIUM—11. Operations: Hysterectomy for fibromyoma; Fothergill operation for procidentia.

ST. LUKE'S AND CHILDREN'S HOSPITAL

LEONARD AVERETT and staff—10. Operative clinic: Vaginal approach to pelvic pathology and vaginal hysterectomies; Kerr low cervical cesarean section.

ST. MARY'S HOSPITAL

J. G. SABOL—9. Gynecological clinic.

STETSON HOSPITAL

STEPHEN E. TRACY and staff—9. Gynecological clinic.

WEST JERSEY HOMEOPATHIC HOSPITAL

C. F. HADLEY, E. C. HESSERT, and staff—10:30. Gynecological operations.

WOMAN'S MEDICAL COLLEGE HOSPITAL

FAITH S. FETTERMAN—9. Demonstration of patients and technique: Fulguration treatment of ulcerative submucous cystitis.

MARGARET C. STURGIS—10. Demonstration: Uterosalpinography, technique and evaluation of uterosalpingograms.

CATHARINE MACFARLANE and HELEN INGLEBY—11. Round table conference: Value of periodic pelvic examinations in preventing cancer of the uterus; report on the findings in 1200 volunteers.

CATHARINE MACFARLANE and staff—2. Gynecological operations.

WOMEN'S HOMEOPATHIC HOSPITAL

W. C. MERCER—9. Gynecological clinic.

Friday

BROAD STREET HOSPITAL

W. C. MERCER—9. Operations: Uterine fibroid; hysterectomy; anterior and posterior colporrhaphy; uterine suspension.

BRYN MAWR HOSPITAL

JOHN B. MONTGOMERY and THOMAS J. COSTELLO—2. Résumé of obstetrical clinic.

CHESTNUT HILL HOSPITAL

Z. B. NEWTON and H. CURTIS WOOD—11. Operations.

FITZGERALD-MERCY HOSPITAL

W. BENSON HARER—9. Gynecological operations.

HAHNEMANN HOSPITAL

HENRY L. CROWTHER and RICHARD R. GATES—10. Care of premature baby; management of abortion.

HOSPITAL FOR DISEASES OF STOMACH

HARRY STUCKERT—11. Gynecological operations.

HOSPITAL OF UNIVERSITY OF PENNSYLVANIA

CARL BACHMAN and staff—9. Obstetrical operations and demonstrations.

PHILIP F. WILLIAMS—12. Round table discussion: Treatment of abortion. FREDERIC J. TAUSSIG, St. Louis, Missouri, chairman.

JEFFERSON HOSPITAL

P. BROOKE BLAND—9. Operations.

JAMES L. RICHARDS, THOMAS J. COSTELLO, and DAVID M. FARRELL—9. Operations.

CLYDE SPANGLER—10. Ward rounds.

LEWIS C. SCHEFFEY and WILLIAM J. THUDIUM—11:30. Uterine cancer follow-up clinic.

JACOB HOFFMAN—12. Endocrinological clinic.

NORRIS W. VAUX and HOBART A. REIMANN—12. Symposium: Pulmonary complications in obstetrical and surgical practice.

KENSINGTON HOSPITAL FOR WOMEN

WALTER M. HEYL—9. Demonstration of the use of a placental blood bank.

MR. STEINBERG and MR. BROWN—9. Demonstration of the principles of blood coagulation and the control of hemorrhages.

E. A. SCHUMANN and staff—9. Obstetrical operations.

MOUNT SINAI HOSPITAL

CHARLES MAZER and staff—9. Operations.

PENNSYLVANIA HOSPITAL

NORRIS W. VAUX and staff—9. Operations and demonstration of cases.

PHILADELPHIA GENERAL HOSPITAL

CHARLES S. MILLER and FRANKLIN F. OSTERHOUT—1. Operative and dry clinic.

ST. JOSEPH'S HOSPITAL

D. S. O'DONNELL—11. Obstetrical clinic.

E. W. GILHOOL—2. Obstetrical clinic.

TEMPLE UNIVERSITY HOSPITAL

HARRY A. DUNCAN—12. Operative and dry clinic: Gynecological.

J. O. ARNOLD—3. Dry clinic and round table discussion: Obstetrics.

WOMAN'S MEDICAL COLLEGE HOSPITAL

ANN GRAY TAYLOR—2. Obstetrical clinic: Abnormal cases.

Days to be Announced

JEWISH HOSPITAL

C. J. STAMM, JACOB WALKER, and PHILIP F. WILLIAMS. Operations.

GENITO-URINARY SURGERY

Monday

GRADUATE HOSPITAL OF UNIVERSITY OF PENNSYLVANIA

JOSEPH C. BIRDSALL and staff—2. Operative and dry clinic.

PENNSYLVANIA HOSPITAL

WILLIAM J. EZICKSON—2. Renal calculus research clinic.

ST. MARY'S HOSPITAL

W. H. HAINES—1. Operative and dry clinic.

TEMPLE UNIVERSITY HOSPITAL

W. HERSEY THOMAS and staff—3. Operative and dry clinic.

Tuesday

GERMANTOWN HOSPITAL

STANLEY Q. WEST and HAROLD S. RAMBO—10. Operative and dry clinic.

GRADUATE HOSPITAL OF UNIVERSITY OF PENNSYLVANIA

WILLIAM H. MACKINNEY and EDWARD A. MULLEN—2. Operative and dry clinic.

HAHNEMANN HOSPITAL

LEON T. ASHCRAFT and WILLIAM HUNSICKER, JR.—2. Operations.

HOSPITAL OF UNIVERSITY OF PENNSYLVANIA

ALEXANDER RANDALL and staff—2. Operative and dry clinic.

JEFFERSON HOSPITAL

D. M. DAVIS—9. Diagnostic clinic, ward walk.

JEWISH HOSPITAL

JOHN B. LOWNES—9. Operations.
LEON SOLIS-COHEN—9. Urological radiological exhibit.

MOUNT SINAI HOSPITAL

MAURICE MUSCHAT and staff—1:30. Operations.

ST. LUKE'S AND CHILDREN'S HOSPITAL

L. F. MILLIKEN and staff—2. Dry clinic: Plastic surgery of the kidney; demonstration of cases.

TEMPLE UNIVERSITY HOSPITAL

W. HERSEY THOMAS and staff—3. Operative and dry clinic.

U. S. NAVAL HOSPITAL

V. H. CARSON and G. E. GAYLER—9. Operations.
V. H. CARSON and G. E. GAYLER—2. Dry clinic.

Wednesday

ABINGTON MEMORIAL HOSPITAL

ALEXANDER RANDALL and staff—9. Operations.

CHESTNUT HILL HOSPITAL

ALEXANDER RANDALL, FREDERICK S. SCHOFIELD, and FRANK P. MASSANISO—11. Operations.

COOPER HOSPITAL

D. F. BENTLEY and R. BETANCOURT—2. Operative and dry clinic: Prostatic surgery.

GERMANTOWN HOSPITAL

JOHN B. LOWNES, F. S. SCHOFIELD, and FRANK P. MASSANISO—10. Operative and dry clinic.

HAHNEMANN HOSPITAL

LEON T. ASHCRAFT and WILLIAM HUNSICKER, JR.—9. Operations.

JEFFERSON HOSPITAL

D. M. DAVIS and staff—9. Operations.
KARL KORNBLUM—9. Urological radiological cases.

PHILADELPHIA GENERAL HOSPITAL

WILLIAM H. MACKINNEY, W. HERSEY THOMAS, WILLARD H. KINNEY, and EDWARD A. MULLEN—9. Symposium on genito-urinary diseases.

PRESBYTERIAN HOSPITAL

JOSEPH C. BIRDSALL, FRANCIS G. HARRISON, and HENRY SANGREE—2. Operative and dry clinic.

ST. JOSEPH'S HOSPITAL

WILLIAM J. EZICKSON—2. Round table discussion on urological problems.

ST. LUKE'S AND CHILDREN'S HOSPITAL

E. W. CAMPBELL and staff—9. Operative and dry clinics

ST. MARY'S HOSPITAL

W. H. HAINES—2. Operations.

Thursday

AMERICAN ONCOLOGIC HOSPITAL

A. E. BOTHE and EMMETT F. CICCONE—10. Operative and dry clinic: Cancer of genito-urinary tract.

CHESTNUT HILL HOSPITAL

FREDERICK S. SCHOFIELD—9. Operations.

DELAWARE COUNTY HOSPITAL

W. H. KINNEY—10. Operative and dry clinic.

GERMANTOWN HOSPITAL

STANLEY Q. WEST and HAROLD S. RAMBO—10. Operative and dry clinic.

HOSPITAL OF UNIVERSITY OF PENNSYLVANIA

ALEXANDER RANDALL and staff—2. Dry clinic:
P. B. HUGHES. Bilateral functional effect of unilateral renal denervation in nephrosis.
S. W. MULHOLLAND. Relationship of urology to the problem of hypertension.
ALEXANDER RANDALL. The etiology of renal calculus.
E. P. PENDERGRASS and P. B. HUGHES. The value of serial pyelography in evaluating the efficiency of urinary transportation.
Staff members. Informative case reports.

JEFFERSON HOSPITAL

D. M. DAVIS and staff—9. Operations.

MEMORIAL HOSPITAL

E. A. MULLEN—3. Operations.

MISERICORDIA HOSPITAL

A. E. BOTHE—2. Operations.

MOUNT SINAI HOSPITAL

MAURICE MUSCHAT and staff—1:30. Operations

PENNSYLVANIA HOSPITAL

LEON HERMAN and staff—2. Operative and dry clinic.

TEMPLE UNIVERSITY HOSPITAL

W. HERSEY THOMAS and staff—3. Operative and dry clinic.

U. S. NAVAL HOSPITAL

V. H. CARSON—2. Dry clinic.

WOMAN'S MEDICAL COLLEGE HOSPITAL

FAITH S. FETTERMAN—9. Operative and dry clinic.

WOMEN'S HOMEOPATHIC HOSPITAL

LEON T. ASHCRAFT—2:30. Operative and dry clinic.

Friday

ABINGTON MEMORIAL HOSPITAL

ALEXANDER RANDALL and staff—9. Operations.

BRYN MAWR HOSPITAL

LEON HERMAN and LLOYD B. GREENE—2. Operations.

GERMANTOWN HOSPITAL

JOHN B. LOWNES, F. S. SCHOFIELD, and FRANK P. MASSANISO—10. Operative and dry clinic.

GRADUATE HOSPITAL OF UNIVERSITY OF PENNSYLVANIA

JOSEPH C. BIRDSALL—2. Operative and dry clinic.

HAHNEMANN HOSPITAL

LEON T. ASHCRAFT and WILLIAM HUNSICKER, JR.—9. Operations.

JEFFERSON HOSPITAL

D. M. DAVIS and staff—9. Operations.

JEWISH HOSPITAL

JOHN B. LOWNES—9. Operations.
LEON SOLIS-COHEN—9. Urological radiological exhibit.

METHODIST EPISCOPAL HOSPITAL

STIRLING W. MOORHEAD and staff—10. Operations.

MISERICORDIA HOSPITAL

A. E. BOTHE—2. Dry clinic: Kidney tumors, types, and treatment.

TEMPLE UNIVERSITY HOSPITAL

W. HERSEY THOMAS and staff—3. Operative and dry clinic.

WOMAN'S HOSPITAL OF PHILADELPHIA

FAITH S. FETTERMAN and staff—9. Urological dry clinic.

FRACTURES AND OTHER TRAUMAS

Monday

HOSPITAL OF UNIVERSITY OF PENNSYLVANIA

L. K. FERGUSON, WILLIAM H. ERB, W. D. THOMPSON, and LOUIS KAPLAN—2. Traumatic surgery: Immediate treatment of traumatic wounds; treatment of sprains by injection of local anesthesia; diagnosis and treatment of knee injuries; prophylaxis and treatment of tetanus; prophylaxis and treatment of gas gangrene.

PROTESTANT EPISCOPAL HOSPITAL

I. M. BOYKIN—2. Fractures of lower third of leg, industrial clinic.

Tuesday

ABINGTON MEMORIAL HOSPITAL

DAMON B. PFEIFFER, J. WALTER LEVERING, J. MONTGOMERY DEAVER, and FLETCHER SAIN—3. Fracture clinic: Demonstration of cases, or treatment of compound fractures; fracture dislocation of shoulder; closed skeletal reduction cases, open reduction cases; clinic in operation.

JEWISH HOSPITAL

MOSES BEHREND—9. Dry clinic: Compound fractures, immediate fixation and metal plates.
RALPH GOLDSMITH and staff—9. Fracture clinic.

MISERICORDIA HOSPITAL

F. MOGAVERO—11. Lecture: Experiences with the Smith-Petersen nail.

PRESBYTERIAN HOSPITAL

JOHN PAUL NORTH—9. Dry clinic:
ORVILLE C. KING. Walking casts.
AUGUSTUS THORNDIKE (Boston). Sprains of the ankle joint.
THEODORE E. ORR. Traumatic dislocations of the hip.
JAMES B. MASON. Use of cellulose acetate compounds for casts and dressings.
TOM OUTLAND (Sayre). Tears of the supraspinatus tendon.
JOHN PAUL NORTH. Hanging casts in fractures of the humeral shaft.

ST. JOSEPH'S HOSPITAL

J. A. LEHMAN—11. Industrial surgery clinic: Living fascial suture in repair of hernia.

TEMPLE UNIVERSITY HOSPITAL

JOHN ROYAL MOORE—9. Fracture clinic.

WEST JERSEY HOMEOPATHIC HOSPITAL

H. WESLEY JACK and staff—1. Operative and dry clinics: Discussion and presentation of 4 cases of removal of spleen following trauma.

Wednesday

COOPER HOSPITAL

Staff—9. Operative and dry clinic.

NORTHEASTERN HOSPITAL

T. TURNER THOMAS—11. Demonstration of patients, x-rays and end-results: Femur, (1) shaft, (2) intracapsular fractures with and without screw fixation; fractures of tibia and fibula; Pott's fractures with and without posterior dislocation of the ankle, marginal fracture of the tibia; fractures of os calcis; fractures and dislocations at the shoulder, elbow and wrist; motion pictures.

PHILADELPHIA GENERAL HOSPITAL

Staff—2. Symposium on fractures:
CLAY MURRAY, S. HUDOCK, and HARRISON MCLAUGHLIN. Fractures of the shoulder girdle.
B. F. BUZBY. Fractures about the elbow.
TOM OUTLAND. Fractures of the forearm.

Thursday

GRADUATE HOSPITAL OF UNIVERSITY OF PENNSYLVANIA

ROBERT A. GROFF—9. Clinical conference: Responsibility of industry in the management of head injuries.
BERNARD D. JUDOVITCH—10. Dry clinic: Back injuries in industrial surgery.
JOHN C. HOWELL—11. Demonstration: Restoration of joint function after fractures; pain in groin following lifting; tendon repair in industrial surgery.

HOSPITAL OF UNIVERSITY OF PENNSYLVANIA

L. K. FERGUSON, LOUIS KAPLAN, and L. H. HERGESHEIMER—2. Treatment of fractures in ambulatory patients, clinical demonstration; technique and application of unpadded plaster casts for the upper and lower extremities; reduction of fractures under local anesthesia; practical physiotherapy in fractures by active function; treatment of minor ankle fractures by injection of local anesthesia.

JEWISH HOSPITAL

RALPH GOLDSMITH and staff—9. Fracture clinic.

MEMORIAL HOSPITAL

BRUCE L. FLEMING—9. Fracture clinic.

PENNSYLVANIA HOSPITAL

FREDERICK R. ROBBINS—9. Industrial clinic.

Friday

COOPER HOSPITAL

R. S. GAMON and E. R. RISTINE—9. Dry clinic: Fractures.

ST. MARY'S HOSPITAL

W. J. RYAN—9. Operative and dry clinic: Industrial surgery.

SURGERY OF BONES AND JOINTS

Monday

CHILDREN'S HOSPITAL

J. T. NICHOLSON—2. Demonstration of splints. Poliomyelitis: Prevention of foot deformities in younger children by equalization of tendon pull; muscle and fascial transplants.

MOUNT SINAI HOSPITAL

M. B. COOPERMAN—2. Operations.

PROTESTANT EPISCOPAL HOSPITAL

RUTHERFORD L. JOHN—1:30. Orthopedic clinic.

Tuesday

COOPER HOSPITAL

B. FRANKLIN BUZBY, OSWALD R. CARLANDER, and DR. WALLIS—9. Operative and dry clinics: Elbow injuries; spinal fusion.

GRADUATE HOSPITAL OF UNIVERSITY OF PENNSYLVANIA

DEFOREST P. WILLARD, JESSE T. NICHOLSON, and BENJAMIN T. BELL—9. Operative and dry clinics: (1) Reconstruction operation in older congenital hip cases; (2) unusual spine lesions responsible for backache; (3) correction of metatarsus varus in hallux valgus.

ST. JOSEPH'S HOSPITAL

PAUL JEPSON—1. Dry clinic: Low back strain; fusion for chronic low back strain.

ST. LUKE'S AND CHILDREN'S HOSPITAL

JOHN A. BROOKE—2. Dry clinic: Tendon transplantation in selected polio cases; arthrodesis of the knee; serratus magnus paralysis with fascial anchorage to the spinous process.

SHRINER'S HOSPITAL

J. R. MOORE—2. Ward walk.

WOMEN'S HOMEOPATHIC HOSPITAL

E. O. GECKELER—1. Orthopedic dry clinic: Fracture cases, including follow-up treatment.

Wednesday

GRADUATE HOSPITAL OF UNIVERSITY OF PENNSYLVANIA

W. G. ELMER, L. D. FRESCOLN, and PAUL JEPSON—12. Operations: Arthroplasty, elbows and hips; internal derangement of knees.

JEFFERSON HOSPITAL

J. T. RUGH—9. Operations.

MOUNT SINAI HOSPITAL

M. B. COOPERMAN and staff—2. Operations.

PROTESTANT EPISCOPAL HOSPITAL

J. W. KLOPP—10:30. Dry clinic: Fractures of neck of femur; use of nailing in treatment.

RUTHERFORD L. JOHN—1:30. Operative and dry clinic.

ST. CHRISTOPHER'S HOSPITAL

RUTHERFORD L. JOHN—10:30. Operations.

ST. LUKE'S AND CHILDREN'S HOSPITAL

PAUL JEPSON—10. Operative clinic: Internal derangement of knee, exploration: polydactylia, plastic surgical result; nailing of fractured hip.

SHRINER'S HOSPITAL

J. R. MOORE—9. Operations.

U. S. NAVAL HOSPITAL

C. F. MORRISON—9. Operations.

WEST JERSEY HOMEOPATHIC HOSPITAL

S. L. BROWN and staff—9. Operations.

Thursday

BRYN MAWR HOSPITAL

GEORGE WAGONER—9. Operations: Demonstration of selected cases of healed fractures.

GERMANTOWN HOSPITAL

B. FRANKLIN BUZBY and A. D. WALLIS—9. Operative and dry clinic.

HAHNEMANN HOSPITAL

JOHN A. BROOKE, E. O. GECKELER, and DONALD T. JONES—2. Dry clinic: Fractures of neck of femur, internal fixation, Smith-Petersen pin or parallel screws; results of leg shortening; herniation of intervertebral disc, shoulder disabilities; orthopedic problem cases for discussion.

PHILADELPHIA ORTHOPAEDIC HOSPITAL

DEFOREST P. WILLARD and staff—9. Case demonstrations: Treatment of Legg Calvé Perthes disease; five year results of slipped femoral epiphysis; decompression of abscess for paraplegia in Pott's disease.

ST. JOSEPH'S HOSPITAL

PAUL JEPSON—1. Operation: Fusion for chronic low back strain.

SHRINER'S HOSPITAL

J. R. MOORE—9. Demonstration of out-patient clinic.

TEMPLE UNIVERSITY HOSPITAL

JOHN ROYAL MOORE—1. Operations.

U. S. NAVAL HOSPITAL

C. F. MORRISON—2. Dry clinic.

Friday

COOPER HOSPITAL

B. FRANKLIN BUZBY, OSWALD R. CARLANDER, and DR. WALLIS—9. Operative and dry clinic: Knee injuries.

JEWISH HOSPITAL

A. M. RECHTMAN, E. A. BRAV, HENRY SIGMOND, and M. T. HORWITZ—9. Dry clinic: Arthroplasty and resection of the elbow; malignant tumors; backache; lesions of the knee joint.

MOUNT SINAI HOSPITAL

M. B. COOPERMAN and staff—2. Operations.

ST. CHRISTOPHER'S HOSPITAL

RUTHERFORD L. JOHN—10:30. Operations.

SHRINER'S HOSPITAL

J. R. MOORE—9. Operations.

NEUROSURGERY

Tuesday

HOSPITAL OF UNIVERSITY OF PENNSYLVANIA

FRANCIS C. GRANT and staff—9. Operative and dry clinic: Major trigeminal neuralgia (motion pictures).

JEFFERSON HOSPITAL

WILLIAM DUANE, JR.—9. Operations.

TEMPLE UNIVERSITY HOSPITAL

TEMPLE S. FAY—9. Operations.

Wednesday

HOSPITAL OF UNIVERSITY OF PENNSYLVANIA

FRANCIS C. GRANT and staff—9. Dry clinic: Motion picture demonstration of the treatment of spinal cord injuries.

MISERICORDIA HOSPITAL

T. J. RYAN—9. Operative and dry clinic: Craniocerebral injuries.

TEMPLE UNIVERSITY HOSPITAL

TEMPLE S. FAY—9. Operations.

Thursday

HOSPITAL OF UNIVERSITY OF PENNSYLVANIA

FRANCIS C. GRANT and staff—9. Craniotomy for a brain tumor.

JEFFERSON HOSPITAL

WILLIAM DUANE, JR.—9. Operations.

Friday

HOSPITAL OF UNIVERSITY OF PENNSYLVANIA

FRANCIS C. GRANT and staff—9. Dry clinic: Diagnosis and treatment of pituitary disease.

JEFFERSON HOSPITAL

BERNARD J. ALPERS and WILLIAM DUANE, JR.—10. Brain tumors, diagnosis and treatment.

TEMPLE UNIVERSITY HOSPITAL

TEMPLE S. FAY—9. Operations.

PLASTIC AND FACIOMAXILLARY SURGERY

Monday

CHESTNUT HILL HOSPITAL

CHARLES W. GAISER—2. Operations.

NORTHERN LIBERTIES HOSPITAL

SAMUEL COHEN—2. Nasal plastic surgery.

Tuesday

JEFFERSON HOSPITAL

WARREN B. DAVIS—9. Operations.

PENNSYLVANIA HOSPITAL

JAMES R. CAMERON—2. Operations.

PRESBYTERIAN HOSPITAL

ROBERT H. IVY, LAWRENCE CURTIS, and HENRY A. MILLER—9. Operative and dry clinic: Facio-maxillary reconstruction.

Wednesday

GRADUATE HOSPITAL OF UNIVERSITY OF PENNSYLVANIA

SAMUEL COHEN—3. Nasal plastic operation.

LANKENAU HOSPITAL

HANS MAY—9. Plastic and reconstructive surgery.

Thursday

AMERICAN ONCOLOGIC HOSPITAL

GEORGE M. DORRANCE and JOHN W. BRANSFIELD—11. Dry clinic.

GRADUATE HOSPITAL OF UNIVERSITY OF PENNSYLVANIA

EDMUND B. SPAETH—2. Plastic surgery of the eye.

JEFFERSON HOSPITAL

WARREN B. DAVIS—9. Operations.

Friday

GRADUATE HOSPITAL OF UNIVERSITY OF PENNSYLVANIA

ROBERT H. IVY, LAWRENCE CURTIS, and HENRY A. MILLER—9. Operations.

HAHNEMANN HOSPITAL

THOMAS L. DOYLE—9. Operations.

LANKENAU HOSPITAL

HANS MAY—9. Plastic and reconstructive surgery.

MOUNT SINAI HOSPITAL

V. FRANK—2. Operations.

ST. JOSEPH'S HOSPITAL

WILLIAM J. MCKINLEY—9. Operative and dry clinic.

THORACIC SURGERY

Tuesday

HOSPITAL OF UNIVERSITY OF PENNSYLVANIA

JULIAN JOHNSON and staff—2. Dry clinic:
- RICHARD H. MEADE. The surgical treatment of pulmonary tuberculosis.
- GABRIEL TUCKER. The bronchoscopic aspects of thoracic surgery.
- JULIAN JOHNSON. The surgical treatment of pulmonary malignancy and bronchiectasis.

JEFFERSON HOSPITAL

HOWARD H. BRADSHAW and GEORGE WILLAUER—11:30. Dry clinic: Thoracic diseases.

PHILADELPHIA GENERAL HOSPITAL

Staff—9. Symposium on empyema, atelectasis sulfapyridine:
- E. L. ELIASON. Empyema results.
- E. BURVILLE-HOLMES. Roentgenological aspects of empyema.
- LEON SCHWARTZ. Clinical studies on sulfapyridine.
- V. W. MURRAY WRIGHT. Basal atelectasis following general surgical operations.

MOSES BEHREND, RICHARD H. MEADE, JR., RUBIN M. LEWIS, and ALBERT BEHREND—2. Operative and dry clinics: Phrenic nerve operations; pneumolysis; thoracoplasty; extrapleural pneumothorax.

Wednesday

GRADUATE HOSPITAL OF UNIVERSITY OF PENNSYLVANIA

WALTER E. LEE—10. Constrictive pericarditis.

JEFFERSON HOSPITAL

HOWARD H. BRADSHAW and GEORGE WILLAUER—2. Operative clinic: Thoracic diseases.

PENNSYLVANIA HOSPITAL

JOHN B. FLICK and staff—9. Operative and dry clinic.

JOHN T. BAUER—3. Dry clinic: Carcinoma of the lung, diagnosis by sputum examination.

PROTESTANT EPISCOPAL HOSPITAL

RICHARD H. MEADE, JR.—9. Operative and dry clinic: Thoracoplasty for pulmonary tuberculosis.

Thursday

GRADUATE HOSPITAL OF UNIVERSITY OF PENNSYLVANIA

J. W. CUTLER—2. Operations: Extrapleural and intrapleural pneumolysis in surgical therapy of tuberculosis.

TEMPLE UNIVERSITY HOSPITAL

W. EMORY BURNETT—9. Operative clinic.

Staff—2. Dry clinic: Thoracic diseases (chest conference).

BRONCHO-ESOPHAGOLOGY

(See also clinical schedules under Otorhinolaryngology)

Monday

TEMPLE UNIVERSITY HOSPITAL

CHEVALIER L. JACKSON and staff—1. Broncho-esophagological clinic: Bronchoscopy as an aid to the thoracic surgeon.

Tuesday

HOSPITAL OF UNIVERSITY OF PENNSYLVANIA

GABRIEL TUCKER, WILLIAM A. LELL, and J. P. ATKINS—9. Direct laryngoscopy.

GABRIEL TUCKER—2. Dry clinic: Laryngeal tumors, benign and malignant; demonstration of patients and colored motion pictures on the technique of direct laryngoscopy, laryngofissure and laryngectomy.

JEWISH HOSPITAL

LOUIS H. CLERF, R. M. LUKENS, and C. J. SWALM—3. Bronchoscopic clinic.

PHILADELPHIA GENERAL HOSPITAL

GEORGE L. WHELAN—9. Bronchoscopic clinic.

PROTESTANT EPISCOPAL HOSPITAL

WILLIAM A. LELL—2. Bronchoscopic clinic: Motion picture demonstration, "The Larynx."

TEMPLE UNIVERSITY HOSPITAL

CHEVALIER L. JACKSON—11. Dry clinics: Diseases of the esophagus; diverticulum of the hypopharynx and one stage operation for its surgical cure (motion pictures).

Wednesday

JEFFERSON HOSPITAL

LOUIS H. CLERF—9. Bronchoscopic clinic.

MISERICORDIA HOSPITAL

GABRIEL TUCKER, JOSEPH P. ATKINS, and WILLIAM A. LELL—2. Operative and dry clinic.

MOUNT SINAI HOSPITAL

W. A. LELL and staff—10. Operative and dry clinic.

PHILADELPHIA GENERAL HOSPITAL

LOUIS H. CLERF—1. Bronchoscopic clinic: Malignant tumors.

WOMAN'S MEDICAL COLLEGE HOSPITAL

EMILY VAN LOON and associates—9. Bronchoscopic clinic.

Thursday

FRANKFORD HOSPITAL

GEORGE A. RICHARDSON—1:30. Bronchoscopic clinic.

GRADUATE HOSPITAL OF UNIVERSITY OF PENNSYLVANIA

GABRIEL TUCKER, WILLIAM A. LELL, and J. P. ATKINS—9. Bronchoscopic clinic.

JEFFERSON HOSPITAL

LOUIS H. CLERF—1. Bronchoscopic clinic.

NORTHERN LIBERTIES HOSPITAL

N. M. LEVIN—9. Bronchoscopic clinic.

PHILADELPHIA GENERAL HOSPITAL

GEORGE L. WHELAN—9. Bronchoscopic clinic.

ST. CHRISTOPHER'S HOSPITAL

EMILY VAN LOON—9. Bronchoscopy in allergic children.

TEMPLE UNIVERSITY HOSPITAL

CHEVALIER L. JACKSON and staff—2:30. Broncho-esophagological clinic. 4:30. Chest conference.

U. S. NAVAL HOSPITAL

F. HARBERT—2. Bronchoscopic clinic.

Friday

GRADUATE HOSPITAL OF UNIVERSITY OF PENNSYLVANIA

GABRIEL TUCKER and WALTER E. LEE—10. Surgical management of esophageal diverticula.

HOSPITAL OF UNIVERSITY OF PENNSYLVANIA

GABRIEL TUCKER, WILLIAM A. LELL, and J. P. ATKINS—9. Bronchology and esophagology.

TEMPLE UNIVERSITY HOSPITAL

CHEVALIER L. JACKSON and WILLIAM A. SWALM—11. Gastroscopic clinic.

OTORHINOLARYNGOLOGY

(See also clinical schedules under Broncho-Esophagology)

Monday

BRYN MAWR HOSPITAL

EDWIN P. LONGAKER—2. Operations.

CHILDREN'S HOSPITAL

WILLIAM HEWSON—1. Dry clinic: Sinus infections in children, diagnosis, and treatment.

LLOYD S. HUTCHINSON and MALCOLM N. WILMES—3. Operations: Tonsillectomy in children.

DELAWARE COUNTY HOSPITAL

FRANK O. HENDRICKSON—2. Operations.

GRADUATE HOSPITAL OF UNIVERSITY OF PENNSYLVANIA

RALPH BUTLER and WALTER ROBERTS—2. Operative and dry clinic.

HOSPITAL OF UNIVERSITY OF PENNSYLVANIA

HARRY P. SCHENCK and LOUIS E. SILCOX—2. Operations.

Staff—2. Dry clinic:

DELAZON BOSTWICK. Notes on septal surgery.

JULIUS WINSTON. Neuro-otological clinic.

L. E. SILCOX. Subluxation of the nasal septum.

J. C. DONNELLY. Audible tinnitus; presentation of patients.

H. P. SCHENCK. Carcinoma of the nasal septum.

KARL M. HOUSER. Submucous resection of the nasal septum.

JEWISH HOSPITAL

H. M. GODDARD—2. Operations: Submucous resection; tonsillectomy; maxillary sinus.

MOUNT SINAI HOSPITAL

M. S. ERSNER—2:30. Operations.

PENNSYLVANIA HOSPITAL

WILLIAM HEWSON and THOMAS GOWEN—2. Operations.

EDWARD H. CAMPBELL—2. Diagnostic methods in nose and throat conditions.

PHILADELPHIA GENERAL HOSPITAL

HERBERT M. GODDARD—2. Tonsil and submucous clinic.

PRESBYTERIAN HOSPITAL

WALTER L. CARISS, DOUGLAS MACFARLAN, RICHARD W. GARLICHS, and E. W. KEMNER—2. Operative and dry clinic.

ST. JOSEPH'S HOSPITAL

T. F. GOWEN—1. Operative and dry clinic.

ST. MARY'S HOSPITAL

E. J. MURPHY—1. Operations.

TEMPLE UNIVERSITY HOSPITAL

ROBERT F. RIDPATH and staff—2. Rhinological clinic.

WOMAN'S HOSPITAL OF PHILADELPHIA

HENRIETTA T. TANNER—2. Operations: Tonsillectomy and adenoidectomy.

Tuesday

COOPER HOSPITAL

ORAM R. KLINE, ERNEST R. HIRST, and staff—2. Operations.

DELAWARE COUNTY HOSPITAL

W. K. KISTLER—2. Operative and dry clinics.

FITZGERALD-MERCY HOSPITAL

CORNELIUS T. MCCARTHY—1. Radical mastoidectomy, report on three cases of lateral sinus thrombosis with recovery. Treatment of otolaryngological cases with sulfanilamide.

FRANKFORD HOSPITAL

ROBERT WATT—1:30. Operative and dry clinic

GERMANTOWN HOSPITAL

H. J. WILLIAMS, C. B. OWINGS, C. E. TOWSON, VALENTINE MILLER, and WILLIAM HITSCHLER—2. Operative and dry clinic.

GRADUATE HOSPITAL OF UNIVERSITY OF PENNSYLVANIA

GEORGE M. COATES and BENJAMIN H. SHUSTER—2. Operative and dry clinics: Otolaryngology and neurotology.

GEORGE B. WOOD—2. Operative and dry clinic.

HAHNEMANN HOSPITAL

CHARLES B. HOLLIS—2. Operations.

HOSPITAL FOR DISEASES OF STOMACH

ROBERT J. HUNTER—2. Functional ear test.

HOSPITAL OF UNIVERSITY OF PENNSYLVANIA

GABRIEL TUCKER, WILLIAM A. LELL, and J. P. ATKINS—9. Direct laryngoscopy.

JULIUS WINSTON and D. S. BOSTWICK—2. Operations.

GABRIEL TUCKER—2. Dry clinic: Laryngeal tumors, benign and malignant; demonstration of patients and colored motion pictures on the technique of direct laryngoscopy, laryngofissure, and laryngectomy.

Staff—2. Dry clinic: Surgical treatment of deafness.
EDWARD H. CAMPBELL. New surgical treatment of conductive deafness.
OSCAR BATSON. Anatomical considerations.
WALTER HUGHSON. Surgery of deafness.
JAMES A. BABBITT. Newer phases of otosclerosis.
D. W. BRONK. Excitation of sensory nerves by normal and pathological processes.

JEFFERSON HOSPITAL

LOUIS H. CLERF—9. Cancer of larynx.

H. H. LOTT—9. Tonsil clinic.

H. J. WILLIAMS—1. Dry clinic: Facial paralysis occurring during the course of chronic suppurative otitis media, and its treatment.

LANKENAU HOSPITAL

EDWARD H. CAMPBELL—2. Otolaryngological clinic.

METHODIST EPISCOPAL HOSPITAL

WALTER ROBERTS and staff—2. Operations.

MISERICORDIA HOSPITAL

R. J. BRENNAN—2. Lecture: Treatment of sinusitis.

MOUNT SINAI HOSPITAL

D. N. HUSIK—1:30. Operations.

PENNSYLVANIA HOSPITAL

ORAM KLINE, HENRY A. MILLER, and HOWARD HEBBLE—2. Operations.

ROMEO A. LUONGO and ANTHONY C. BRANCATO—2. Dry clinic: Diagnostic methods in nose and throat conditions.

LOUIS E. SILCOX—2. Operations: Tonsillectomy, general anesthesia.

PHILADELPHIA GENERAL HOSPITAL

LOUIS J. BURNS—2. Laryngeal tuberculosis.

ST. JOSEPH'S HOSPITAL

ARTHUR WRIGLEY—11. Operative and dry clinic.

ST. LUKE'S AND CHILDREN'S HOSPITAL

SETH BRUMM and staff—2. Operative clinic.

ST. MARY'S HOSPITAL

W. P. GRADY—9. Operative and dry clinic.

TEMPLE UNIVERSITY HOSPITAL

MATTHEW S. ERSNER, EDWARD K. MITCHELL, S. BRUCE GREENWAY, and DAVID MYERS—2. Otological clinic.

WEST JERSEY HOMEOPATHIC HOSPITAL

E. S. HALLINGER and staff—2. Operations.

Wednesday

CHESTNUT HILL HOSPITAL

JOHN R. DAVIES, JR., GEORGE T. FARIS, and DARIUS G. ORNSTON—1:30. Operations.

CHILDREN'S HOSPITAL

F. HAROLD KRAUSS—1. Sinus infections in children, diagnosis and treatment; tonsil and mastoid operations.

FITZGERALD-MERCY HOSPITAL

J. E. LOFTUS—1. Mastoid operations.

GRADUATE HOSPITAL OF UNIVERSITY OF PENNSYLVANIA

RALPH BUTLER and WALTER ROBERTS—2. Operative and dry clinic.

HAHNEMANN HOSPITAL

JOSEPH V. CLAY—2. Operations.

HOSPITAL OF UNIVERSITY OF PENNSYLVANIA

EDWARD H. CAMPBELL and O. V. BATSON—2. Operations.

Staff—2. Dry clinic: Chemotherapy in otolaryngology.
D. SERGEANT PEPPER. Limitations of chemotherapy.
H. F. FLIPPIN. Chemotherapy in meningitis.
THOMAS FITZ-HUGH, JR. Hematological effects of drug therapy.
HARRY P. SCHENCK. Procedures supplementing chemotherapy.
KARL M. HOUSER. Chemotherapy in otolaryngology.
E. P. PENDERGRASS. Effects of chemotherapy upon roentgenological findings.

JEFFERSON HOSPITAL

A. T. SMITH—10. Tumors of nose and sinuses.

H. J. WILLIAMS—1. Operative and dry clinic.

JEWISH HOSPITAL

A. S. KAUFMAN—1. Mastoid operations.

MISERICORDIA HOSPITAL

C. T. MCCARTHY—2. Operations: Tonsillectomy, local, LaForce, dissection; submucous resection; simple and radical mastoid; results of sulfanilamide in mastoiditis.

GABRIEL TUCKER, JOSEPH P. ATKINS, and WILLIAM A. LELL—2. Operative and dry clinic.

PHILADELPHIA GENERAL HOSPITAL

ROBERT J. HUNTER—2. Recent advances of otology.

PROTESTANT EPISCOPAL HOSPITAL

ALLEN BERTOLET and staff—2. Operations.

ST. CHRISTOPHER'S HOSPITAL

HAROLD KRAUSS and GOMER T. WILLIAMS—2. Operations.

ST. JOSEPH'S HOSPITAL

R. L. DICKSON—11. Operations.

ST. LUKE'S AND CHILDREN'S HOSPITAL

GEORGE MACKENZIE and staff—2. Demonstration of cases: Radical mastoids.

STETSON HOSPITAL

C. H. GRIMES and staff—12. Operative and dry clinic.

TEMPLE UNIVERSITY HOSPITAL

ROBERT F. RIDPATH and staff—2. Rhinological clinic.

WEST JERSEY HOMEOPATHIC HOSPITAL

E. S. HALLINGER and staff—2. Operations.

WOMAN'S HOSPITAL OF PHILADELPHIA

CATHERINE ARTHURS and staff—2. Operations.

Thursday

ABINGTON MEMORIAL HOSPITAL

WALTER HUGHSON—3. Demonstration of the physiology of hearing.

BRYN MAWR HOSPITAL

CHARLES A. PRYOR—2. Operations.

CHESTNUT HILL HOSPITAL

B. D. PARISH and FRED E. TRAGANZA—2. Operations.

FITZGERALD-MERCY HOSPITAL

CORNELIUS T. MCCARTHY—1. Operations.

GERMANTOWN HOSPITAL

H. J. WILLIAMS, C. B. OWINGS, C. E. TOWSON, VALENTINE MILLER, and WILLIAM HITSCHLER—2. Operations.

GRADUATE HOSPITAL OF UNIVERSITY OF PENNSYLVANIA

GABRIEL TUCKER, WILLIAM A. LELL, and J. P. ATKINS—9. Bronchoscopic clinic.

GEORGE M. COATES and B. H. SHUSTER—2. Operative and dry clinics: Otolaryngology and neuro-otology.

GEORGE B. WOOD—2. Operative and dry clinic.

HAHNEMANN HOSPITAL

CHARLES B. HOLLIS—2. Operations.

HOSPITAL OF UNIVERSITY OF PENNSYLVANIA

J. C. DONNELLY and H. SCHLUDERBERG—2. Operations.

Staff—2. Dry clinic.

VALENTINE MILLER. Demonstration: Loose areolar tissue of the larynx.

J. C. DONNELLY. Allergy of the upper respiratory tract and its relation to bronchiectasis.

FREDERICK H. KRAUSS. New method of tonsillectomy under vinethene anesthesia.

ROBERT J. HUNTER. Interpreting tuning fork time in decibels.

FRANCIS C. GRANT. Otitic brain abscess.

ELLIOTT CLARK and RICHARD ABELL. Studies of reactions in living tissue.

JEFFERSON HOSPITAL

A. T. SMITH—9. Tonsil clinic.

A. T. SMITH—1. Sinus clinic.

JEWISH HOSPITAL

H. B. COHEN—1. Operations.

MEMORIAL HOSPITAL

H. J. WILLIAMS—2. Radical mastoid operations.

METHODIST EPISCOPAL HOSPITAL

WALTER ROBERTS and staff—2. Operations.

MISERICORDIA HOSPITAL

J. E. LOFTUS—2. Dry clinic: Mastoid surgery.

MOUNT SINAI HOSPITAL

MORRIS A. WEINSTEIN—2. Operations.

PENNSYLVANIA HOSPITAL

WILLIAM HEWSON, ORAM KLINE, and ROMEO LUONGO—2. Operations.

WILLIAM HEWSON, HOWARD HEBBLE, and LOUIS E. SILCOX—2. Dry Clinic: Diagnostic methods in nose and throat conditions.

EDWARD H. CAMPBELL—2. Mastoid operations.

PHILADELPHIA GENERAL HOSPITAL

BENJAMIN H. SHUSTER—2. Laryngeal tuberculosis.

PROTESTANT EPISCOPAL HOSPITAL

OTTO C. HIRST and staff—2. Operations.

ST. LUKE'S AND CHILDREN'S HOSPITAL

WILLIAM WHELAN, BENJAMIN SHUSTER, and staff—2. Lantern slide demonstration showing patients before and after radical operation for disease of the frontal, ethmoid and maxillary sinuses, with proptosis of the eye ball.

ST. MARY'S HOSPITAL

E. J. HOLLAND—1. Operative and dry clinic.

TEMPLE UNIVERSITY HOSPITAL

CHEVALIER L. JACKSON and W. WAYNE BABCOCK—1. Dry clinic: Surgical treatment of cancer of the larynx, laryngofissure, and laryngectomy.

N. M. LEVIN—1. Teaching the laryngectomized patient to talk.

MATTHEW S. ERSNER and staff—2. Otological clinic: Demonstration of cases where labyrinthian fenestrations were performed for the relief of deafness.

U. S. NAVAL HOSPITAL

T. S. MORING, C. W. STELLE, and F. HARBERT—9. Operative and dry clinic.

Friday

CHILDREN'S HOSPITAL

EDWARD H. CAMPBELL—1. Sinus infections in children, diagnosis and treatment; mastoid operations.

FITZGERALD-MERÇY HOSPITAL

J. E. LOFTUS—1. Operations.

GRADUATE HOSPITAL OF UNIVERSITY OF PENNSYLVANIA

GABRIEL TUCKER and WALTER E. LEE—10. Surgical management of esophageal diverticula.

HOSPITAL OF UNIVERSITY OF PENNSYLVANIA

GABRIEL TUCKER, WILLIAM A. LELL, and J. P. ATKINS—9. Bronchology and esophagology.

KARL M. HOUSER and E. W. KEMNER—2. Operations.

LANKENAU HOSPITAL

EDWARD H. CAMPBELL—2. Otolaryngological clinic.

PENNSYLVANIA HOSPITAL

THOMAS GOWEN and HENRY A. MILLER—2. Operations.
THOMAS GOWEN and EDWARD J. GOUGH—2. Dry clinic: Diagnostic methods in nose and throat conditions.
THOMAS GOWEN and WILLIAM DANEHOWER—2. Operations: Tonsillectomy and mastoidectomy.

PHILADELPHIA GENERAL HOSPITAL

DAVID N. HUSIK—2. Operative and dry clinic.

ST. CHRISTOPHER'S HOSPITAL

HAROLD KRAUSS and GOMER T. WILLIAMS—10. Operations.

ST. MARY'S HOSPITAL

T. J. WALSH—1. Operative and dry clinic.

WOMEN'S HOMEOPATHIC HOSPITAL

J. R. CRISWELL—2. Radical mastoid operation.

OPHTHALMOLOGY

Monday

COOPER HOSPITAL

J. S. SHIPMAN and staff—2. Operations.

GRADUATE HOSPITAL OF UNIVERSITY OF PENNSYLVANIA

L. C. PETER and staff—2. Dry clinic.

HOSPITAL OF UNIVERSITY OF PENNSYLVANIA

FRANCIS HEED ADLER—2. Operative and dry clinic.

JEFFERSON HOSPITAL

C. E. G. SHANNON—2. Operative and dry clinic.

LANKENAU HOSPITAL

PERCE DELONG—2. Ophthalmological clinic.

MOUNT SINAI HOSPITAL

AARON BARLOW—4. Operations.

PENNSYLVANIA HOSPITAL

A. G. FEWELL—2. Fundus clinic.

PRESBYTERIAN HOSPITAL

H. M. LANGDON—2:30. Operative and dry clinic.

PROTESTANT EPISCOPAL HOSPITAL

ANDREW KNOX—2. Operative and dry clinic.

ST. CHRISTOPHER'S HOSPITAL

J. B. FELDMAN—2. Squint clinic.

TEMPLE UNIVERSITY HOSPITAL

WALTER I. LILLIE and staff—1. Operative and dry clinic.

WILLS HOSPITAL

J. M. GRISCOM, F. C. PARKER, and T. A. O'BRIEN—2. Operative and dry clinic.

Tuesday

CHESTNUT HILL HOSPITAL

GEORGE E. BERNER—2. Operations.

GRADUATE HOSPITAL OF UNIVERSITY OF PENNSYLVANIA

WILLIAM T. SHOEMAKER—2. Operative and dry clinic.

HOSPITAL FOR DISEASES OF STOMACH

GEORGE H. DENNEY—1. Cataract cases.

HOSPITAL OF UNIVERSITY OF PENNSYLVANIA

ROBB MCDONALD—10. Dark adaptation.

JEFFERSON HOSPITAL

C. E. G. SHANNON—2. Operative and dry clinic.

PHILADELPHIA GENERAL HOSPITAL

C. R. MULLEN—3. Operative and dry clinic.

PROTESTANT EPISCOPAL HOSPITAL

N. M. BRINKERHOFF—2. Operative and dry clinic.

ST. CHRISTOPHER'S HOSPITAL

J. B. FELDMAN—2. Squint clinic.

ST. LUKE'S AND CHILDREN'S HOSPITAL

F. C. PETERS, S. H. BROWN, and staff—2. Operative clinic.

ST. MARY'S HOSPITAL

F. A. MURPHY—1. Operative and dry clinic.

TEMPLE UNIVERSITY HOSPITAL

WALTER I. LILLIE and staff—1. Operative and dry clinic.

WILLS HOSPITAL

I. S. TASSMAN—9. Refraction; orthoptics.
PERCE DELONG—9. Pathological laboratory.
Inspection of hospital—9 and 2. Superintendent and assistant.
LOUIS LEHRFELD, W. S. REESE, and C. R. MULLEN—2. Operative and dry clinic.
E. W. SPACKMAN—2. X-ray clinic.
I. S. TASSMAN—2. Refraction; orthoptics.
PERCE DELONG—2. Pathological laboratory.

Wednesday

BRYN MAWR HOSPITAL

T. DELORME FORDYCE—2. Operative and dry clinic.

GRADUATE HOSPITAL OF UNIVERSITY OF PENNSYLVANIA

L. C. PETER and staff—2. Operations.

GERMANTOWN HOSPITAL

CARL WILLIAMS and ALBERT C. SAUTTER—10. Operations.

HOSPITAL OF UNIVERSITY OF PENNSYLVANIA

FRANCIS HEED ADLER—2. Operative and dry clinic.

JEFFERSON HOSPITAL

C. E. G. SHANNON—2. Operative and dry clinic.

LANKENAU HOSPITAL

PERCE DELONG—2. Ophthalmological clinic.

PRESBYTERIAN HOSPITAL

H. M. LANGDON—2:30. Operative and dry clinic.

PROTESTANT EPISCOPAL HOSPITAL

ANDREW KNOX—2. Operative and dry clinic.

ST. CHRISTOPHER'S HOSPITAL

J. B. FELDMAN—3. Operations.

ST. LUKE'S AND CHILDREN'S HOSPITAL

F. C. PETERS, S. H. BROWN, and staff—2. Operative clinic.

WILLS HOSPITAL

I. S. TASSMAN—9. Refraction; orthoptics.
PERCE DELONG—9. Pathological laboratory.
Inspection of hospital—9 and 2. Superintendent and assistant.
JAMES S. SHIPMAN, EDMUND B. SPAETH, and WILLIAM J. HARRISON—2. Operative and dry clinic.
E. W. SPACKMAN—2. X-ray clinic.
I. S. TASSMAN—2. Refraction; orthoptics.
PERCE DELONG—2. Pathological laboratory.

Thursday

GRADUATE HOSPITAL OF UNIVERSITY OF PENNSYLVANIA

WILLIAM T. SHOEMAKER—2. Operative and dry clinic.

JEFFERSON HOSPITAL

C. E. G. SHANNON—2. Operative and dry clinic.

MOUNT SINAI HOSPITAL

AARON BARLOW—4. Operations.

PHILADELPHIA GENERAL HOSPITAL

C. R. MULLEN—3. Operative and dry clinic.

PROTESTANT EPISCOPAL HOSPITAL

N. M. BRINKERHOFF—2. Operative and dry clinic.

ST. CHRISTOPHER'S HOSPITAL

J. B. FELDMAN—2. Squint clinic.

ST. LUKE'S AND CHILDREN'S HOSPITAL

F. C. PETERS, S. H. BROWN, and staff—9. Operations.

ST. MARY'S HOSPITAL

R. T. M. DONNELLY—10. Operations.

TEMPLE UNIVERSITY HOSPITAL

WALTER I. LILLIE and staff—1. Operative and dry clinic.

U. S. NAVAL HOSPITAL

T. S. MORING, C. W. STELLE, and F. HARBERT—9. Operative and dry clinic.

WILLS HOSPITAL

I. S. TASSMAN—9. Refraction; orthoptics.
PERCE DELONG—9. Pathological laboratory.
Inspection of hospital—9 and 2. Superintendent and assistant.
J. M. GRISCOM, F. C. PARKER, and T. A. O'BRIEN—2. Operative and dry clinic.
E. W. SPACKMAN—2. X-ray clinic.
I. S. TASSMAN—2. Refraction; orthoptics.
PERCE DELONG—2. Pathological laboratory.

Friday

GRADUATE HOSPITAL OF UNIVERSITY OF PENNSYLVANIA

L. C. PETER and staff—2. Dry clinic.

HAHNEMANN HOSPITAL

FREDERICK C. PETERS and staff—2. Operations.

HOSPITAL OF UNIVERSITY OF PENNSYLVANIA

FRANCIS HEED ADLER—2. Operative and dry clinic.

JEFFERSON HOSPITAL

C. E. G. SHANNON—2. Operative and dry clinic.

PENNSYLVANIA HOSPITAL

A. G. FEWELL—2. Fundus clinic.

PRESBYTERIAN HOSPITAL

H. M. LANGDON—2:30. Operative and dry clinic.

PROTESTANT EPISCOPAL HOSPITAL

ANDREW KNOX—2. Operative and dry clinic.

ST. CHRISTOPHER'S HOSPITAL

J. B. FELDMAN—2. Squint clinic.

ST. JOSEPH'S HOSPITAL

THOMAS O'BRIEN—4. Operative and dry clinic.

TEMPLE UNIVERSITY HOSPITAL

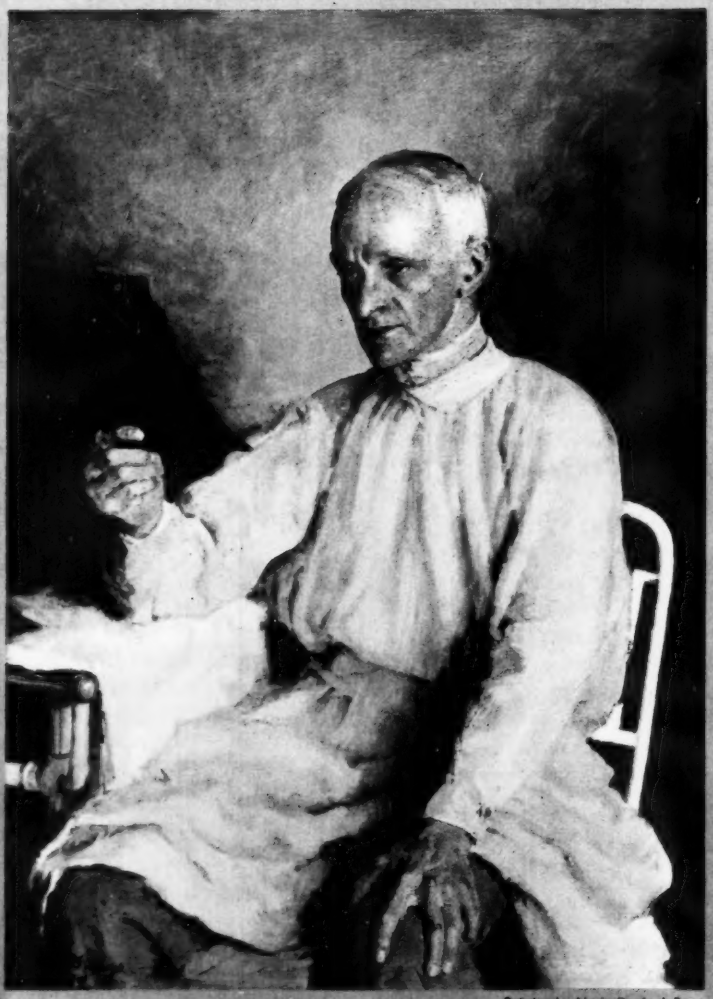
WALTER I. LILLIE and staff—1. Operative and dry clinic.

WILLS HOSPITAL

I. S. TASSMAN—9. Refraction; orthoptics.
PERCE DELONG—9. Pathological laboratory.
Inspection of hospital—9 and 2. Superintendent and assistant.
LOUIS LEHRFELD, W. S. REESE, and C. R. MULLEN—2. Operative and dry clinic.
E. W. SPACKMAN—2. X-ray clinic.
I. S. TASSMAN—2. Refraction; orthoptics.
PERCE DELONG—2. Pathological laboratory.

WOMEN'S HOMEOPATHIC HOSPITAL

C. J. V. FRIES—2. Dry clinic: Traumatic eye injuries and infections.



Painting by Marie Danforth Page

HARVEY CUSHING

APRIL 8, 1869—OCTOBER 7, 1939